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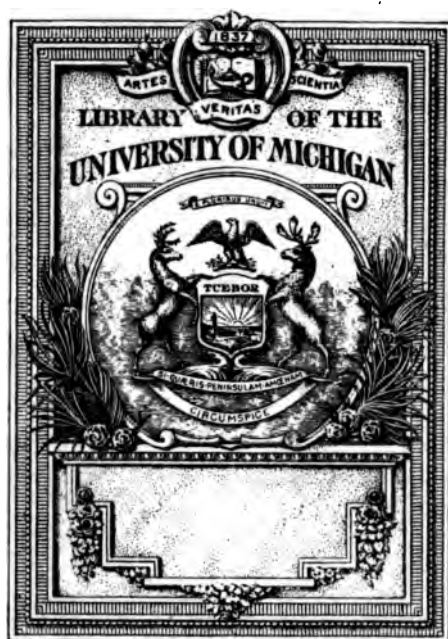
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COAST ARTILLERY
WAR GAME

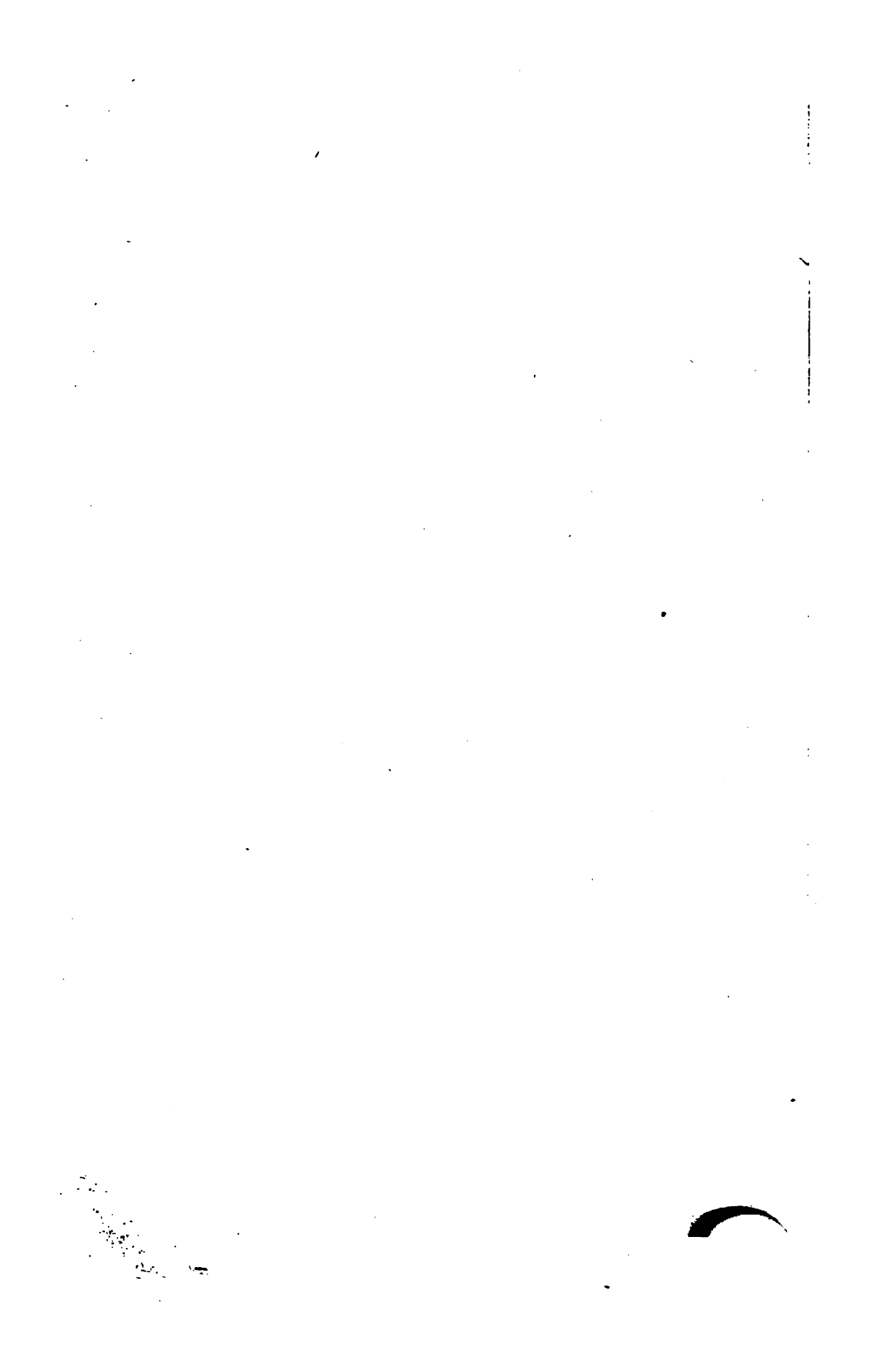
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PLATE 1.



COAST ARTILLERY WAR GAME BOARD, FORT ANDREWS, MASS.

WAR DEPARTMENT
OFFICE OF THE CHIEF OF STAFF

COAST ARTILLERY WAR GAME

BY

MAJ. WILLIAM CHAMBERLAINE
Coast Artillery Corps, U. S. Army

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FOURTH EDITION



WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

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WAR DEPARTMENT,
OFFICE OF THE CHIEF OF STAFF,

Washington, June 26, 1916.

The Coast Artillery War Game, prepared under the direction of the Chief of Coast Artillery, by Maj. William Chamberlaine, Coast Artillery Corps, is published for use as a textbook in the postgraduate course, garrison school for officers, under paragraph 45 (a), General Orders, No. 70, War Department, 1910, and for the information of the Regular Army and Organized Militia of the United States.

By order of the Secretary of War:

H. L. SCOTT,
Major General, Chief of Staff.

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PREFACE.

The Coast Artillery War Game, which is now installed in practically all Coast Artillery posts, has by a gradual process been brought to its present state of development. It provides a means of training for officers, noncommissioned officers, and certain enlisted men in the tactical duties which they will be called upon to perform in time of action. Among them are the tactical use of the armament, use of proper commands, correct telephone messages, and rapid and accurate indication and identification of targets. When it is necessary for a battery (or higher commander) to assign targets to observers, gun pointers, or others, delays in promptly selecting and tracking the proper targets will have a direct and immediate effect on the rate of fire. Every proper method of reducing the "dead time" (i. e., the time between the receipt of assignment by battery commander and time of firing first shot) should be encouraged. The great dependence which must be placed upon the observers, particularly on those at outlying base-end stations, is not always fully appreciated. A failure to rapidly grasp the battery commander's wishes as to assignment of targets will have a very serious effect upon the course of an action.

In many defenses the personnel have but little opportunity to see naval vessels and when they do so the men-of-war are seldom available for vessel tracking. Consequently recourse must be had to such desultory commercial craft as may happen to be in the battle area during drill. Since such craft are at best few and are never in naval formation it may safely be said that no opportunity presents itself for practicing fire control under approximately service conditions.

The Coast Artillery War Game offers a substitute for this difficulty, and permits of a fairly good fire-command drill or tactical exercise. It gives each commander an opportunity to immediately supervise the execution of his orders by his juniors, an opportunity which is not possible at artillery drill, since the individual officers and men are widely separated; and it also permits of tactical exercises, involving the use of the various elements of the defense. It does not afford a means of arriving at a definite decision as to the result of an engagement between ships and forts, and any such conclusions drawn from its operations may be entirely erroneous. The methods of scoring gunfire, which have been adopted after many trials, are at the best only approximate and are probably susceptible of improvement.

The game in its present state is largely due to the assistance and encouragement given by the present Chief of Coast Artillery, and to the assistance of many officers who have been identified with its development during the past four years. Among others should be mentioned Capt. Harry C. Barnes, Capt. A. H. Sunderland, Capt. James Totten, Capt. A. L. Rhodes, First Lieut. Robert Arthur, and First Lieut. Sanderford Jarman, Coast Artillery Corps, to whom acknowledgment is hereby made.

WILLIAM CHAMBERLAINE,
Major, Coast Artillery Corps.

COAST ARTILLERY WAR INSTRUCTION,
Fort Andrews, Mass., May 1, 1916.

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COAST ARTILLERY WAR GAME.

CHAPTER I.

COAST ARTILLERY WAR INSTRUCTION.

DESCRIPTION OF APPARATUS.

The war-game board consists of a relief map showing the land and water areas of the harbor in question, mounted on a substantial table. The horizontal scale of the map is 1 inch equals 100 yards. The area of the map should be such as to include the extreme range of the present armament, over land as well as over water. The vertical scale is 1 inch equals 100 feet.

The table.—In building the table to hold the relief map, it is important that it be carefully and securely put together in such a way that the upper surface will not warp. After constructing several boards, experience has indicated that the table should be built on a truss similar to that shown in figure 1. In order to prevent warping, the truss should be constructed of clear, seasoned, straight, dressed 2 by 4 inch cypress, white or yellow pine. It should be bolted together with $\frac{3}{8}$ inch iron bolts. As soon as it is put together, several coats of linseed oil should be applied to keep out moisture and prevent warping.

The surface should be laid of tongue-and-grooved 3 by $1\frac{1}{8}$ -inch dressed, clear, straight, seasoned white or yellow pine, and put down with the care usually applied to flooring. As soon as laid it should be given several coats of linseed oil to prevent warping.

Land areas.—The land features are cut from clear, seasoned $\frac{1}{8}$ -inch white pine (vertical scale 1 inch equals 100 feet) and fastened with glue and small brads to the surface of the board.

The geological survey map (or if available, the coast defense commander's map) should be raised to a horizontal scale of 1 inch equals 100 yards, and each 20-foot contour cut out of the $\frac{1}{4}$ -inch white pine by means of a scroll saw, which is furnished as a part of the war-game equipment. The enlargement of the map can be done by cutting it into small sections about 3 inches square, placing the squares in the balopticon and reflecting the enlarged section on a screen, on which a sheet of paper has been fastened. By moving the balopticon back and forth until the proper magnification has been obtained and tracing the topographical features with a soft pencil, the enlargement can be made rapidly. Each 20-foot contour is then transferred by means of carbon paper to a $\frac{1}{4}$ -inch white-pine board and cut out by means of the scroll saw as indicated above.

The proper contours are superimposed and fastened by glue and brads, and the rough edges smoothed off by a carving tool and sandpapered until a smooth surface is obtained. As soon as a contour is finished it should be given a coat of linseed oil to prevent warping.

The contoured map should be given several additional coats of linseed oil, and then the land areas painted to give a realistic effect. All batteries, roads, villages, cables, telegraph, railroads, and other features of a military value should be represented by small models, as the land area affords a valuable map for working out land-defense problems in conjunction with the seaward defense.

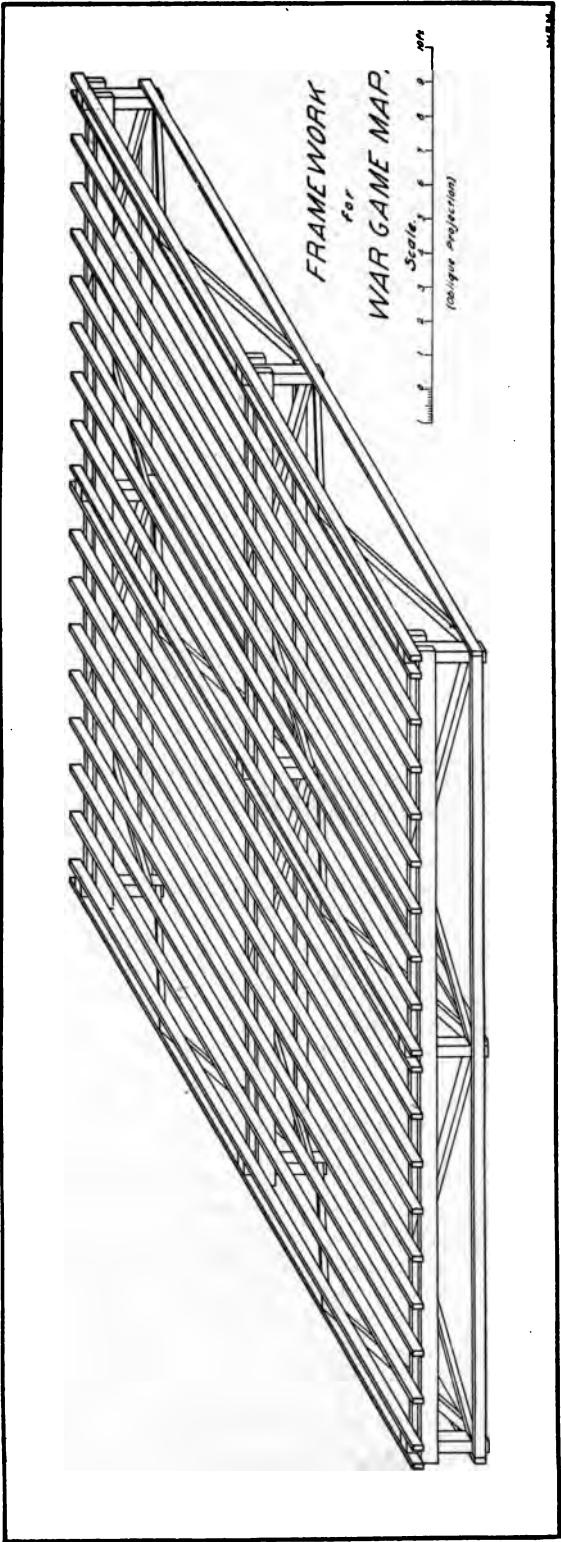


FIGURE 1.

Water areas.—The water areas should be painted a light blue. All lighthouses, buoys, beacons, lightships, are represented by small models. Cables are represented by copper telephone wire. The outlines of shoals and reefs should be represented.

Background.—In order to increase the scenic effect of the ship models when seen through a telescope, the seaward horizon of the board, when viewed from the battery commander's station, is provided with a background. This background consists of a board about 12 inches high, fastened in a vertical position to the extreme seaward edges of the board. It should be painted so as to give a cloud effect, and will materially increase the realistic effect of the marine landscape, causing the models to stand out more prominently. If desirable this background can be made reversible, one side being painted for the day phases to represent clouds, and the reverse side war color (i. e., gray) for use in night phases.

Compass.—A dumb compass about 18 inches in diameter, cut out of 12 by 1 inch board, should be constructed and placed in a convenient position on the board, to be used to facilitate the determination of direction.

Searchlights.—The searchlight beams used in the night phases of the War Game are obtained by projecting, from a source of light under the board, a small pencil of light against a mirror inclined at an angle of about 45° with the plane of the table.

The miniature searchlights are so arranged that a motion in azimuth can be given by means of a cord and pulley (controller) located on the front of the board. The angle of the mirror with the plane of the board can be changed by means of a similar arrangement, thus altering the range of the beam.

The concentration or dispersion of the beam is effected by moving the source of light up or down in the lamp box until the proper width and intensity are obtained. When properly adjusted, the beam should give a well-defined spot of light from 6 to 8 inches at a distance of 10 feet.

The reflecting mirror is mounted on trunnions attached to the mirror support, which can be removed during day phases. Figures 2 and 3 show the details of construction, the methods of assembly, and the nomenclature of the parts.

In mounting the miniature searchlights great care should be taken to get the axis of the shaft vertical, otherwise much trouble will be had in keeping the beam horizontal during motion in azimuth.

A snap switch is provided for turning the power on or off at the commands "In action" or "Out."

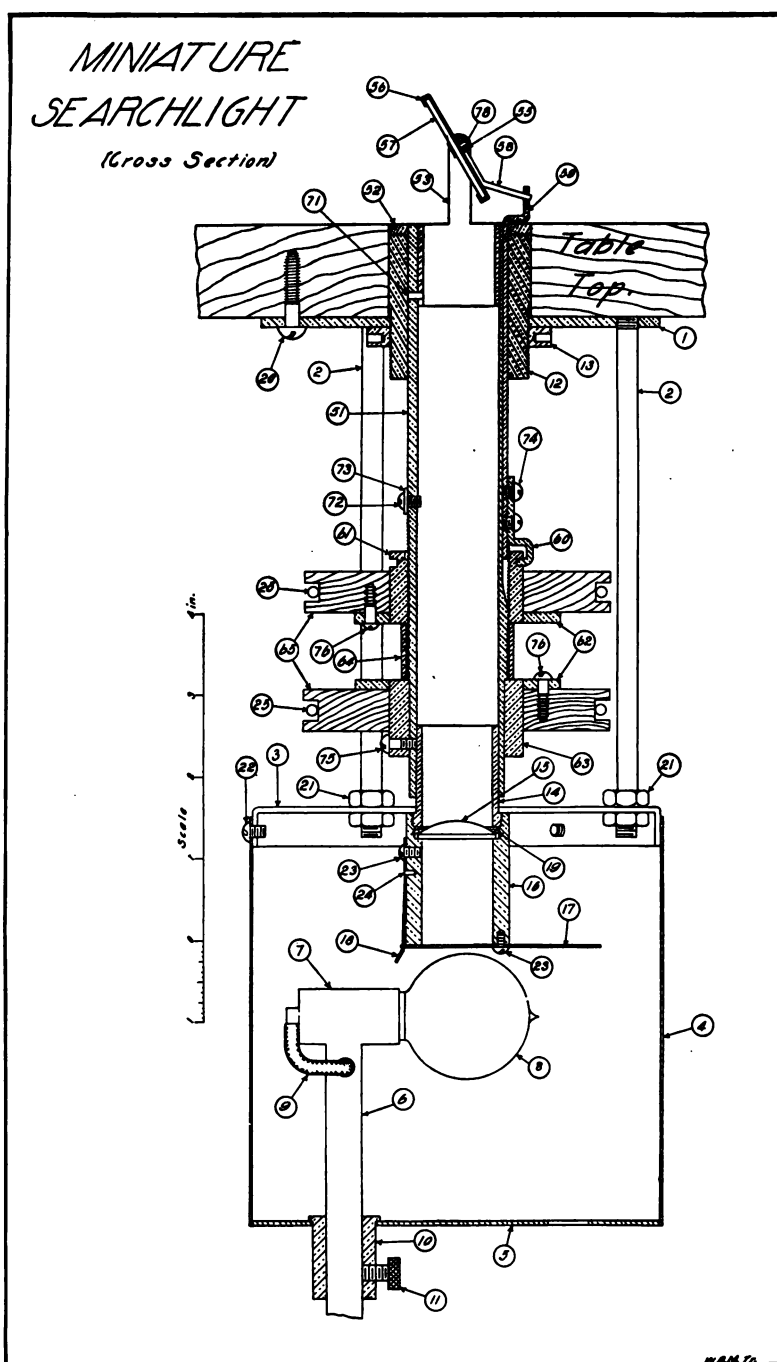
The searchlights are operated (in accordance with the commands of the officer controlling the lights) by operators seated on low stools at the controllers at the front of the board. (See fig. 4.) It should be noted that there are two controllers for each light, i. e., one for azimuth and one for elevation.

One searchlight is supplied for each actual or projected searchlight included in the board in question, and they should be mounted on the board as near their actual position as the construction of the board will permit.

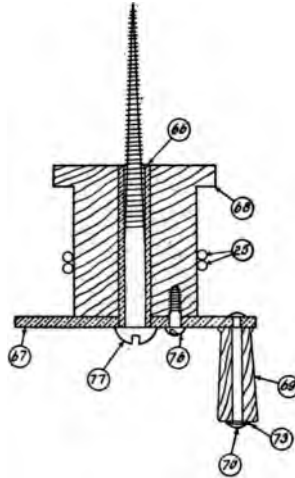
War-game room.—For the proper installation of the Coast Artillery war-instruction apparatus a suitable well-lighted room of not less than 25 by 40 feet is desirable. It is necessary that power be available for use in connection with the searchlights, as well as for interior lighting. The room is divided into two parts by means of a suitable curtain, one end of the room containing the board and the players conducting the attack and the other for those connected with the defense. The accompanying figure 4 shows a convenient arrangement of the material.

Shades.—During night phases it is necessary to darken the room, and for this purpose opaque shades are supplied. The method of installing them so as to exclude all light around the edges is shown in figure 5.

Curtains.—A curtain is hung from a wire in front of the board, so as to conceal the board from view of the battery commanders. The curtain is drawn at the conclusion of each move by an assistant to the umpire.



PULLEY
for
Miniature Searchlight.



NOMENCLATURE,
Miniature Searchlight.

1	Flange.	51	Shaft.
2	Stud.	52	Flange.
3	Top Plate.	53	Mirror Support.
4	Lamp Box.	54	Trunnion.
5	Bottom Plate.	55	Mirror Frame.
6	Slide.	56	Mirror XI" X 14"
7	Receptacle.	57	Elevating Pin.
8	Lamp. Electric, variable type.	58	Elevating Rod.
9	Lamp Cord.	60	Elevating Link.
10	Bushing.	61	Nut.
11	Thumb Screw.	62	Flange.
12	Bushing.	63	Bushing.
13	Lock Nut.	64	Strap.
14	Bushing.	65	Pulleys. (2 each providing 10" travel)
15	Lens. 1 1/2" (single convex type)	66	Bushing 1/2" X 1/2" X 1/2"
16	Lens Tube.	67	Flange.
17	Diaphragm (6, 1/2" x 1/2")	68	Pulley.
18	Latch.	69	Handle.
19	Retainer.	70	Pin.
20	Wood Screw. #8 X 1 1/2"	71	Pin. .077 Dia X 3/16"
21	Nut. Hex. 1/4-24	72	Screw. R.H. 6-40 X 3/16"
22	Screw. R.H. 6-40 X 3/16"	73	Washer.
23	Screw. R.H. 3-36 X 1/4"	74	Screw. R.H. 6-40 X 1/4"
24	Pin. .040 Dia X 1/4"	75	Screw. R.H. 6-40 X 3/16"
25	Line. No. 4 1/2 Braided Cotton	76	Wood Screw. R.H. #4 X 3/8"
		77	Wood Screw. R.H. #4 X 1/2"
		78	Pin. .040 Dia X 3/16"

FIGURE 3.

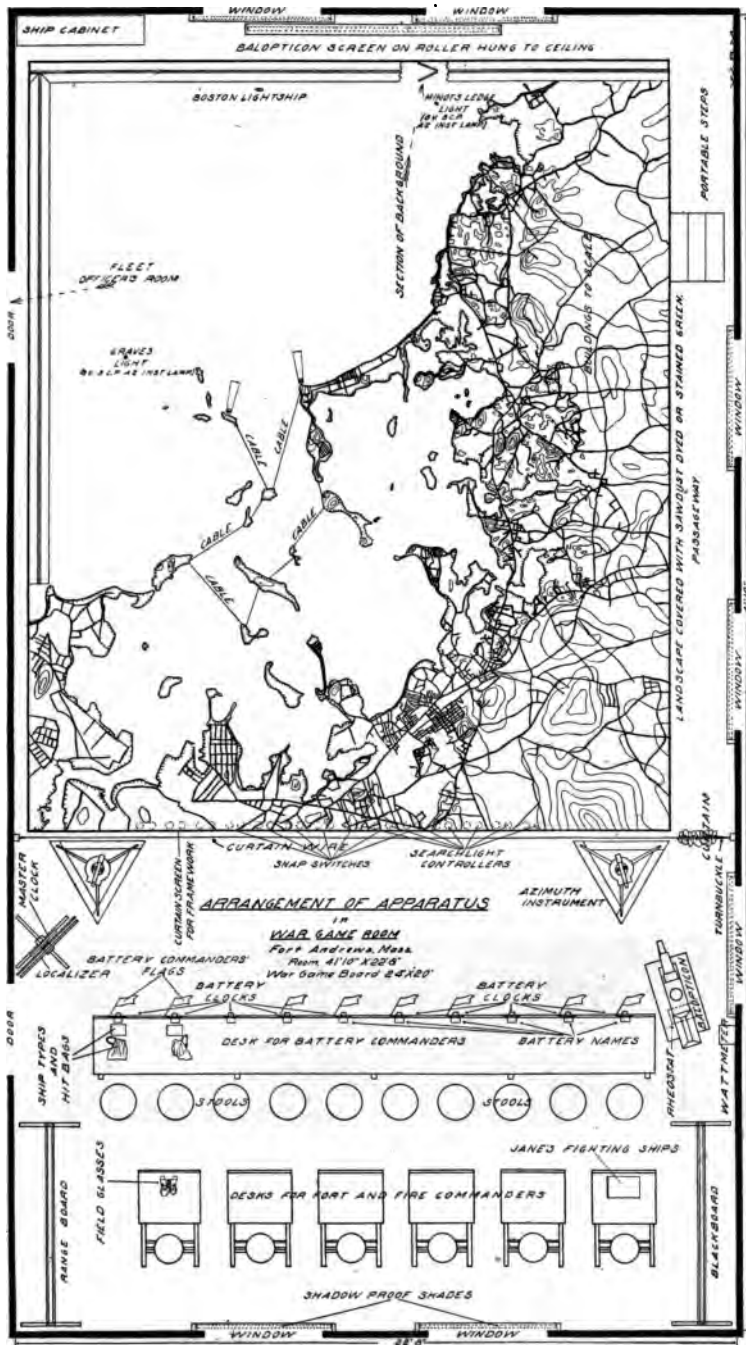


FIGURE 4.

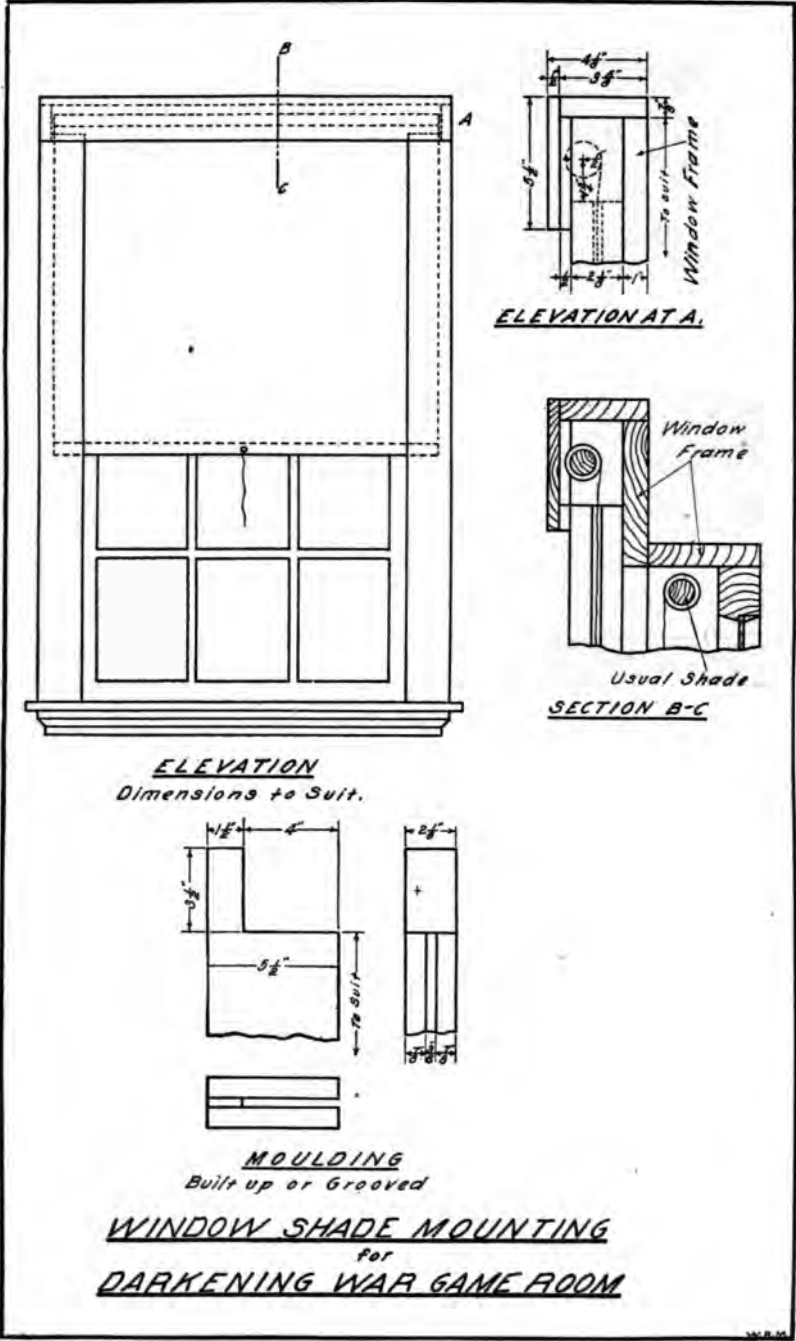
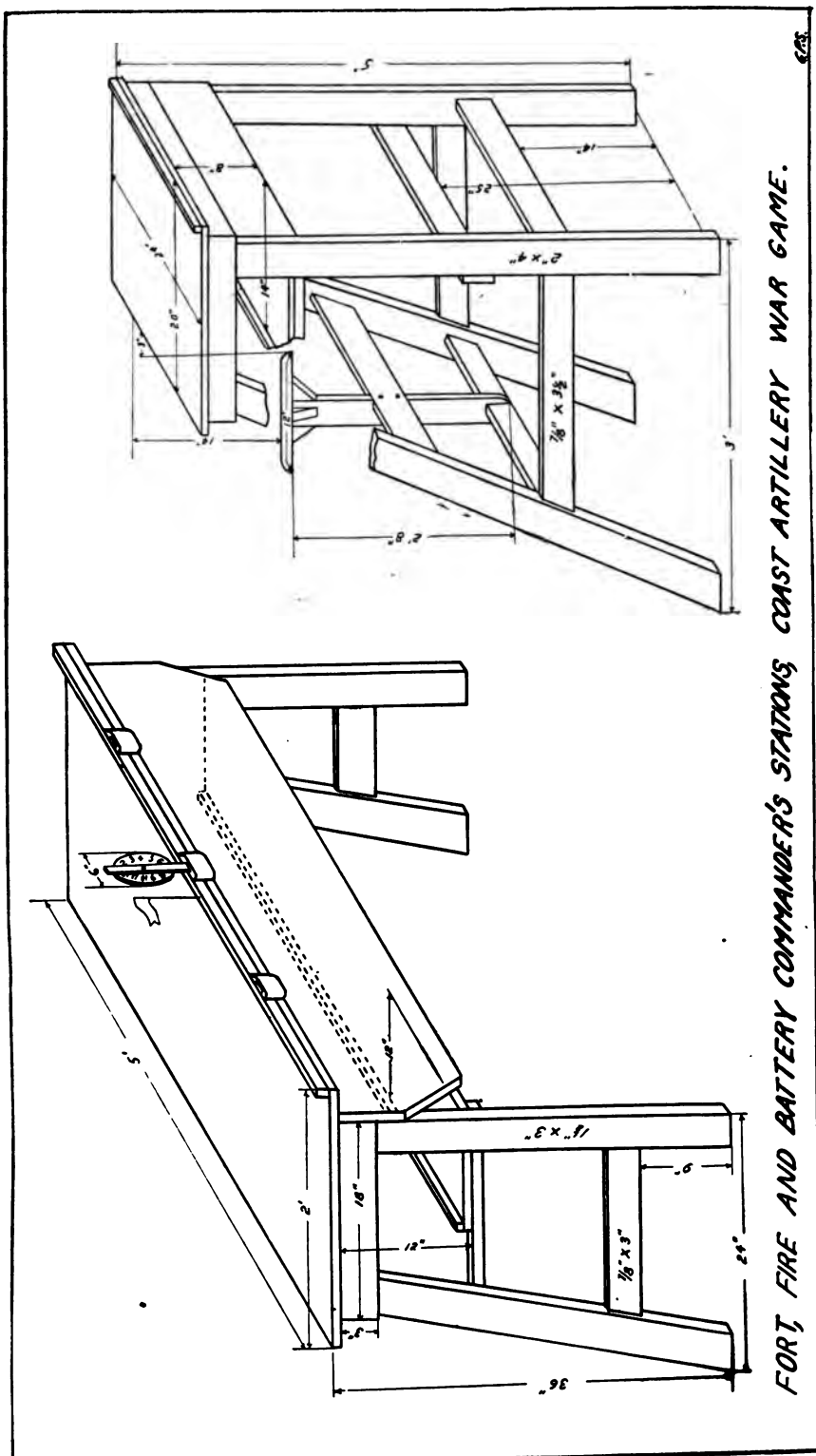


FIGURE 5.



FORT, FIRE AND BATTERY COMMANDER'S STATIONS COAST ARTILLERY WAR GAME.

FIGURE 6.

The object of the curtain is to conceal the players moving the ships during night phases as well as to mark definitely the conclusion of each move.

Another small curtain of green material is fastened on the front end of the war-game board, so as to hide from view the truss and floor underneath the board, thereby increasing the realistic effect of the marine view of the water area. It also serves to cut off any fugitive beams escaping from the lamp box of the searchlights.

Fort, fire, and battery commander's tables.—Battery commanders are grouped by fire commands in one end of the war-game room. Each sits on a revolving stool at specially designed table, so that when the elbows rest on the top of the table, the field glasses of the players will be at the proper height above the plane of the war-game table.

Each table is provided with a shelf for holding notebooks, field-glass cases, hit bags, etc. In front of each battery commander's position is mounted a battery commander's clock and a small flag for indicating when the battery is in action. (See fig. 6.)

The fire commander's tables shown in figure 6 are higher than those of battery commander's, permitting the fire commander to look over them. The fire commander is located approximately in the center of and behind his battery commanders.

The fort commander's desk is of same height as fire commander's and is located approximately at the center of the line of battery commander's.

Field glasses—Azimuth instruments.—Each artillery commander is equipped with a pair of field glasses capable of being focused so as to clearly define the ship models when viewed at a distance of about 25 feet. Signal Corps glass, type E, six power (or a similar glass), is well adapted for this use.

When observers are used, as in battery or fire commander's courses (see p. 29), azimuth instruments are mounted on tripods on each side of the board and near the battery commander's tables. (See fig. 4.)

Range board.—The purpose of the range board is to keep track of the assignment of targets, the number of hits obtained on each, and to permit the battery commanders to know the range to targets under fire. It consists of an ordinary blackboard about 4 by 6 feet, ruled as indicated, and is placed so as to be visible to the battery commanders.

The first five columns are filled in before the phase begins. When a target is assigned to a particular battery an assistant to the umpire enters the range to the nearest even-thousand yards in the sixth column, and the name or symbol of the target in the seventh column. In the eighth column a brief record is kept of the hits or misses scored at each move.

Range board.

Fort commander.	Fire commander.	Battery commander.	Battery.	No.	Range.	Target.	Hits.
Lt. Col.....	(Ft.)..... Maj..... Maj.....	Capt..... Capt..... Capt..... Lieut.....	Whitman. Burnside.. Parke..... Smith..... Etc.....	8-M 2-12" 4-6" 2-6"	10 9 9 7	Kongo..... Arkansas..... Destr. No. 1... Dastr. No. 2...	00101 100100 00011 00100
Etc.....							

The range board is usually placed in front and to right of battery commanders and is kept posted by the assistant who draws the curtain at the conclusion of each move. This assistant also spins the localizer for shore batteries and moves the master clock referred to on page 20.

Range tapes.—Each fort is provided with a range tape by means of which the approximate range of a target from that group of batteries can be quickly determined. The range tapes are strips of tracing linen, one-half inch wide, graduated in thousands of yards to the scale of the board (1 inch equals 100 yards).

One end of the tape is pivoted, by means of a thumb tack, on that portion of the board representing water, as near the batteries as possible. The zero of the graduation is under the thumb tack, and each thousand yards is numbered in ink from the pivot out to the extreme range at which the batteries of the group can fire.

When a target is assigned to a battery, the range tape for that battery is extended to the target and the range indicated to the range-board operator. The range to the target is thereafter measured for each move.

The use of the range tapes will be necessary or desirable only during the initial stages of the instruction, as the director by use of a single graduated wand (10 feet by $\frac{1}{4}$ by $\frac{1}{4}$ inch graduated to each 1,000 yards) can easily and rapidly determine the range to any target.

Hit bags.—Hit bags are provided for each shore battery and for each ship, and are used in the determination of hits, as explained under methods of scoring gun fire. It is a simple bag of cloth, white for day firing and black for night firing, measuring about 4 by 8 inches, furnished with a draw string at one end, and should be plainly marked to indicate caliber of gun or type of ship for which intended. Each hit bag contains 100 half-inch wooden cubes, which are marked as indicated in tables of "Probability of hitting."

The percentage of hits to be expected at the different ranges is based on the result of target practice, upon a theoretical discussion of the various types of guns, the probability of finding the accurate range, probability of a misfire, upon a moral factor for mental stress under fire. The best attainable information has been used and numerous authorities consulted.

If more reliable data be available the numbering of the cubes in the hit bags should be changed to correspond.

Probability of hitting.

ONE HIT IN PIT SALVO, 12-INCH B. L. MORTARS.

Marks on cubes.	Day firing.		Night firing.	
	Per cent hits.	Number cubes.	Per cent hits.	Number cubes.
3.....	66.6	4	38.5	8
4.....	62.7	6	31.3	5
5.....	57.2	6	25.5	5
6.....	51.2	5	20.9	4
7.....	45.6	6	17.2	3
8.....	40.3	4	14.2	2
9.....	35.5	5	12.0	2
10.....	30.9	4	10.0	10
11.....	26.8	4	.....	.....
12.....	23.2	3	.....	.....
13.....	20.2	3	.....	.....
14.....	17.3	2	.....	.....
15.....	15.0	15	.....	.....
Blanks.....	.....	33	Blanks.	61
Total.....	.....	100	.....	100
MAJOR ARMAMENT.				
2.....	90	3	71	21
3.....	87	18	50	16
4.....	69	16	34	10
5.....	53	13	24	8
6.....	40	9	16	4
7.....	31	6	12	3
8.....	25	5	9	1
9.....	20	4	8	1
10.....	16	3	7	7
11.....	13	3	.....	.....
12.....	10	2	.....	.....
13.....	8	1	.....	.....
14.....	7	1	.....	.....
15.....	6	6	.....	.....
Blanks.....	.....	10	Blanks.	29
Total.....	.....	100	.....	100

Probability of hitting—Continued.

ONE HIT IN PIT SALVO, 12-INCH B. L. MORTARS—Continued.

Marks on cubes.	Day firing.		Night firing.	
	Per cent hits.	Number cubes.	Per cent hits.	Number cubes.
INTERMEDIATE ARMAMENT.				
1.....	90	22	90	43
2.....	68	30	47	26
3.....	38	14	21	10
4.....	24	10	11	5
5.....	14	5	6	3
6.....	9	3	3	1
7.....	6	2	2	1
8.....	4	1	1	1
9.....	3	1		
10.....	2	2		
Blanks.....		10	Blanks.....	10
Total.....		100		100
MINOR ARMAMENT.				
1.....	90	30	90	48
2.....	60	29	42	24
3.....	31	15	18	10
4.....	16	8	8	4
5.....	8	4	4	2
6.....	4	1	2	1
7.....	3	3	1	1
Blanks.....		10		10
Total.....		100		100

Localizers.—Two localizers are used to determine the location of hits, one for shots fired at the ships by the forts, the other for shots fired by the ships at the forts.

The localizer for forts consists of wooden wheel, with numbers marked on its face from 1 to 20, and provided with four pointers. Figures 7 and 8 show details of construction and marking. Four pointers are provided, one for each battery in the normal fire command of four batteries. The object of the pointers is to scatter the hits, otherwise all batteries scoring on a given target on any given move would hit at the same place and render estimation of damage difficult for the umpire.

The localizer for ship's fire is a wooden wheel marked as shown in figures 7 and 8. On the circumference are drawn symbols for the various elements of the defense found in the particular coast-defense command. As there are usually a great number of such elements in any given coast-defense command, only one symbol for each kind is placed upon the localizer. For example, there may be ten 60-inch lights installed, but only one symbol is placed on the localizer, and when a 60-inch is hit (i. e., when this symbol stops under a pointer) the umpire decides which particular light in the area under fire is out of action. Similarly only one symbol need be had for major caliber batteries, fire commander's or battery commander's station, etc., the umpire specifying in case of a hit which particular station is out.

Score cards.—These consist of drawings of a typical dreadnaught, battle cruiser, battleship, armored cruiser, light cruiser, monitor, destroyer, and submarine. (See figs. 9, 10, 11, 12, 13, and 14.) Each drawing (except the submarine) has located on it 20 hits, corresponding to the numbers on the localizer. On the light cruiser, monitor, and destroyer only four hits are shown, but they are numbered from 1 to 20. For example, on the destroyer the hit on the stern corresponds to 16, 17, 18, 19, or 20, and similarly on the light cruiser the hit amidship aft corresponds to 11, 12, 13, 14, or 15.

These drawings also show the location and thickness of armor on each class of vessel. Jane's notation for armor is employed. The cards also contain curves of penetration (at 60° angle of impact) of K. C. armor for 6, 8, 12, and 14 inch B. L. R.

The score cards are printed in different-colored inks to facilitate easy recognition of the different types.

These score cards are supplied to coast-defense commanders upon requisition.

Clocks.—A clock face (8 inches diameter and numbered from 1 to 12) is mounted on an upright support fitting in a socket on each battery commander's desk. A larger clock face (18 inches in diameter) is mounted on a wooden frame and is operated

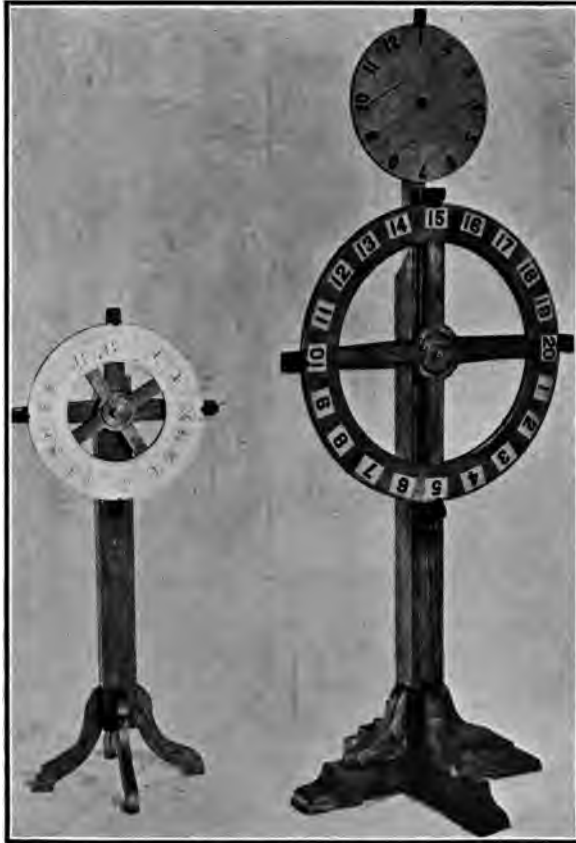


FIGURE 7.

by the range-board operator at the conclusion of each move, as a guide to the battery commander's clock. (See figs. 6 and 7.)

These clocks are necessary to keep track of the moves of the game and to regulate the rate of fire of the batteries.

At the beginning of the first move when the curtain is drawn aside the dials of all clocks are turned so as to indicate 12. Thereafter as the curtain is drawn in front of the board the dial of the master clock is advanced one number.

When a battery is assigned a target its clock is set by the battery commander to the move at which the battery can have completed one minute's firing; that is, four moves ahead of the master clock for mortar batteries, three for major-caliber batteries,

and two for all others. Thus, if during move 2, a 12-inch gun battery is assigned to a target, the battery clock is set at the reading of the master clock plus 3, or at 5. When the curtain is drawn in front of the board and the master clock has been advanced to 5, the proper number of cubes are drawn from the hit bag by the battery commander.

Flags.—A small flag, about 2 by 4 inches, cut out of tin and mounted on a stout wire about 8 inches long, is furnished to each battery commander. When the battery is firing this flag is set upright in a hole in the battery commander's desk in front of the battery commander, and indicates to the umpire that the battery is in action. (Fig. 6.)

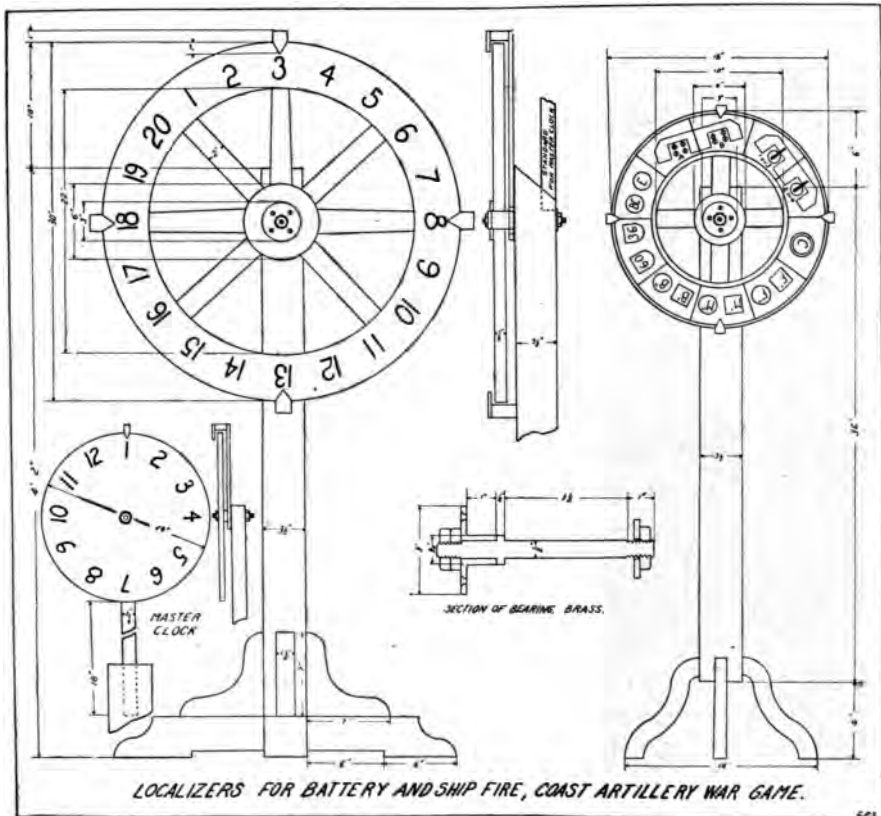


FIGURE 8.

Ammunition sheets.—These are blank forms mimeographed at the post and are used by battery commanders for keeping track of the expenditure of ammunition. (See "Record of Expenditure of Ammunition," page 22.)

Ship models.—The ship models (fig. 15) are made of wood (scale, 1 inch equals 100 feet) and are executed in sufficient detail to make distinguishable the general characteristics of the vessels of which they are the models. Viewed from the point of the battery commander, their appearance is that of the vessels seen with good glasses at about mid range.

For training the players for routine artillery drill, models of both war vessels and commercial craft are used. The former are painted war color and the latter the colors of the vessels they represent. Small paper flags are provided for the ship models to assist the players in determining the nationality of any ship placed upon the board.

COAST ARTILLERY WAR INSTRUCTION TYPE DREADNAUGHT.

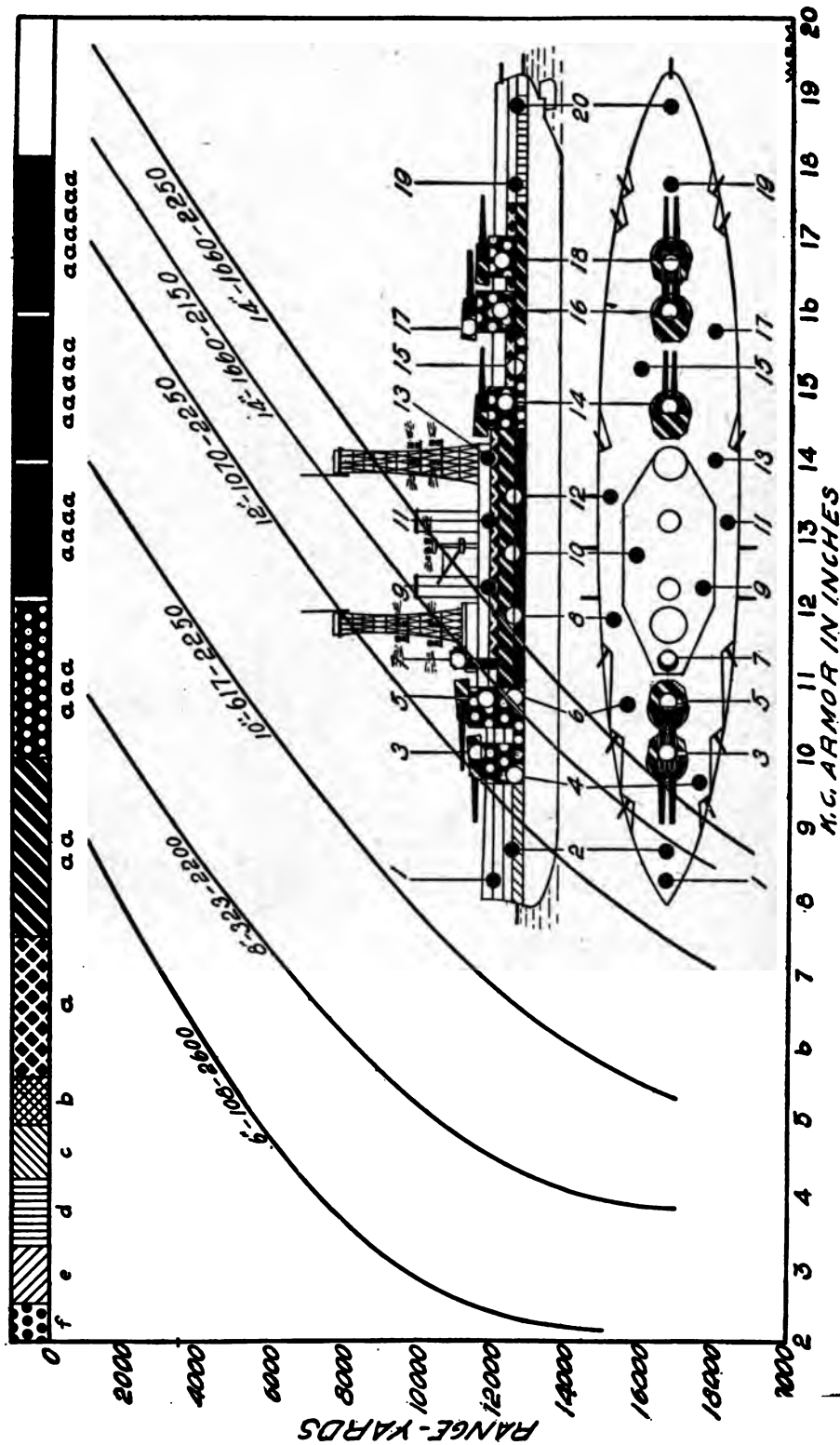


FIGURE 9.

COAST ARTILLERY WAR INSTRUCTION TYPE BATTLE CRUISER.

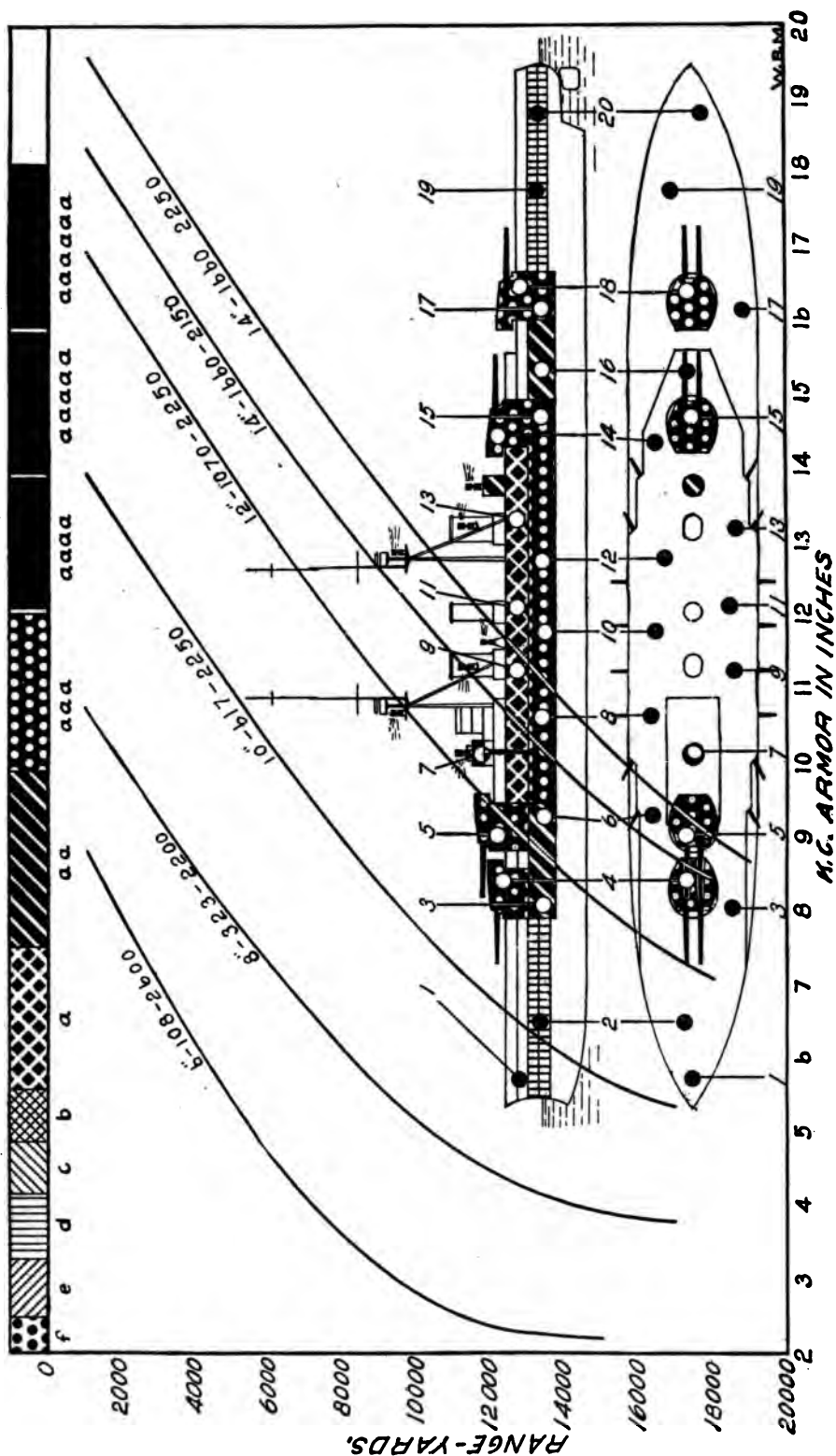


FIGURE 10.

COAST ARTILLERY WAR INSTRUCTION TYPE BATTLESHIP

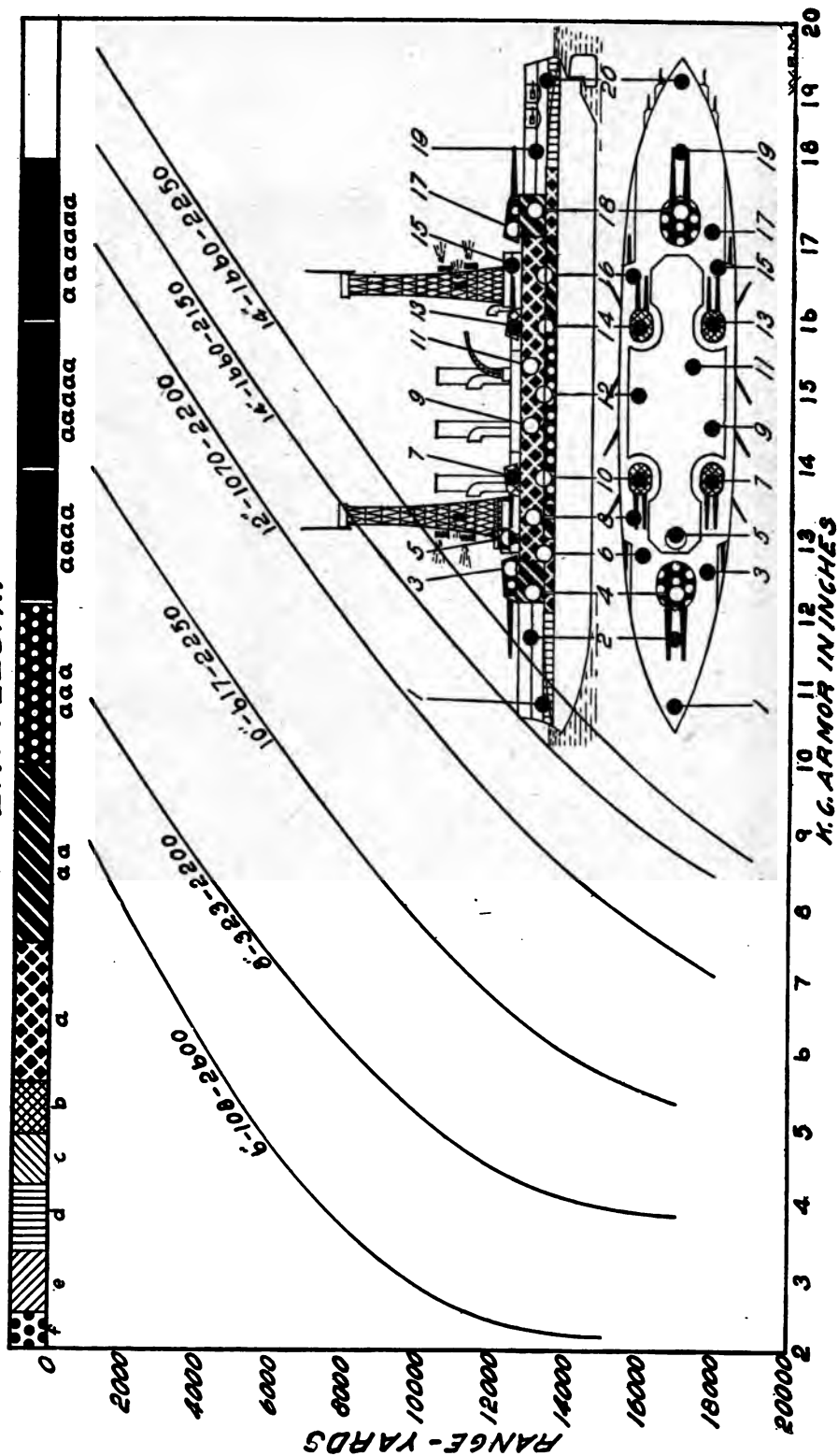
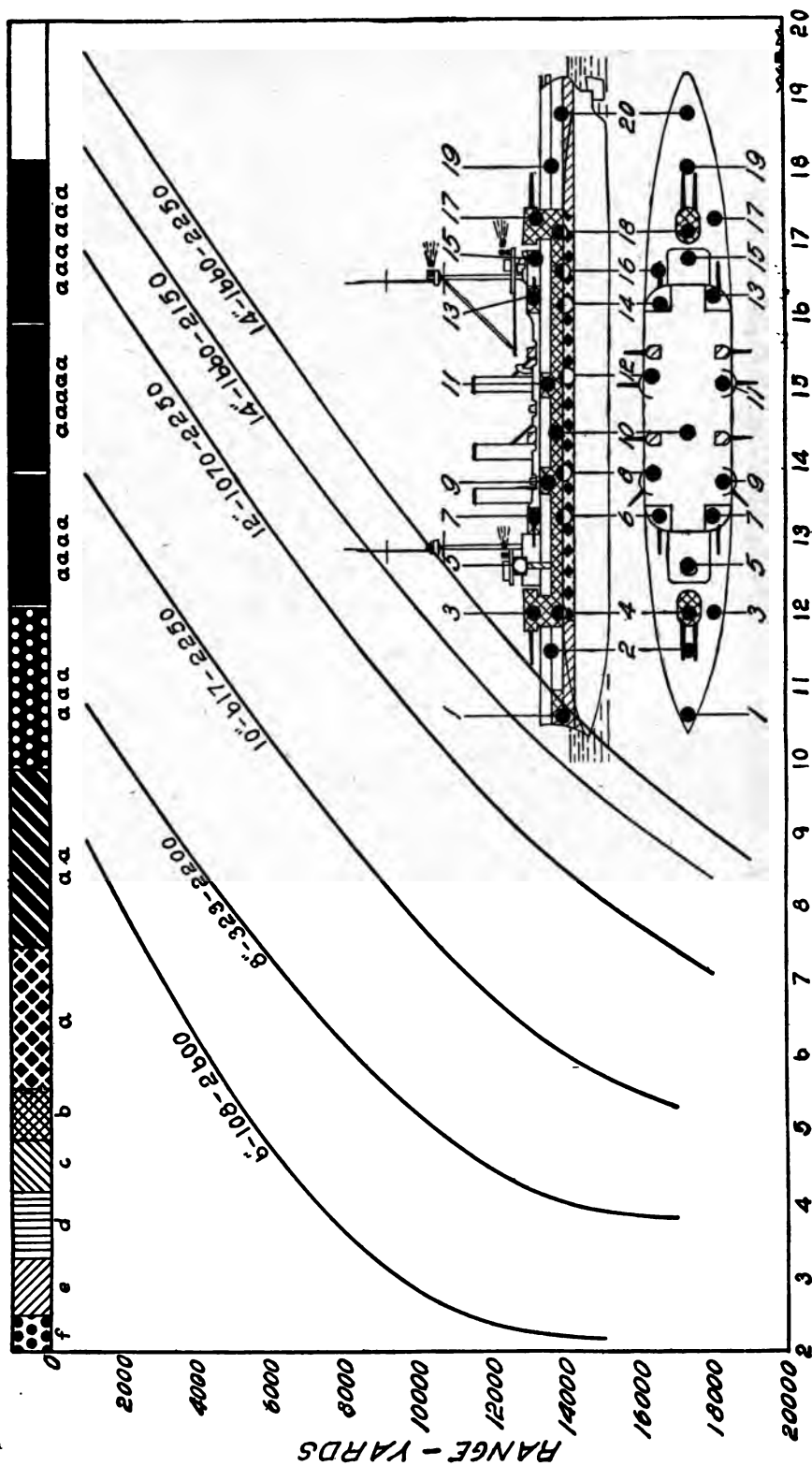


FIGURE 11

COAST ARTILLERY WAR INSTRUCTION

TYPE ARMORED CRUISER



COAST ARTILLERY WAR INSTRUCTION TYPE LIGHT CRUISER

Figure 13

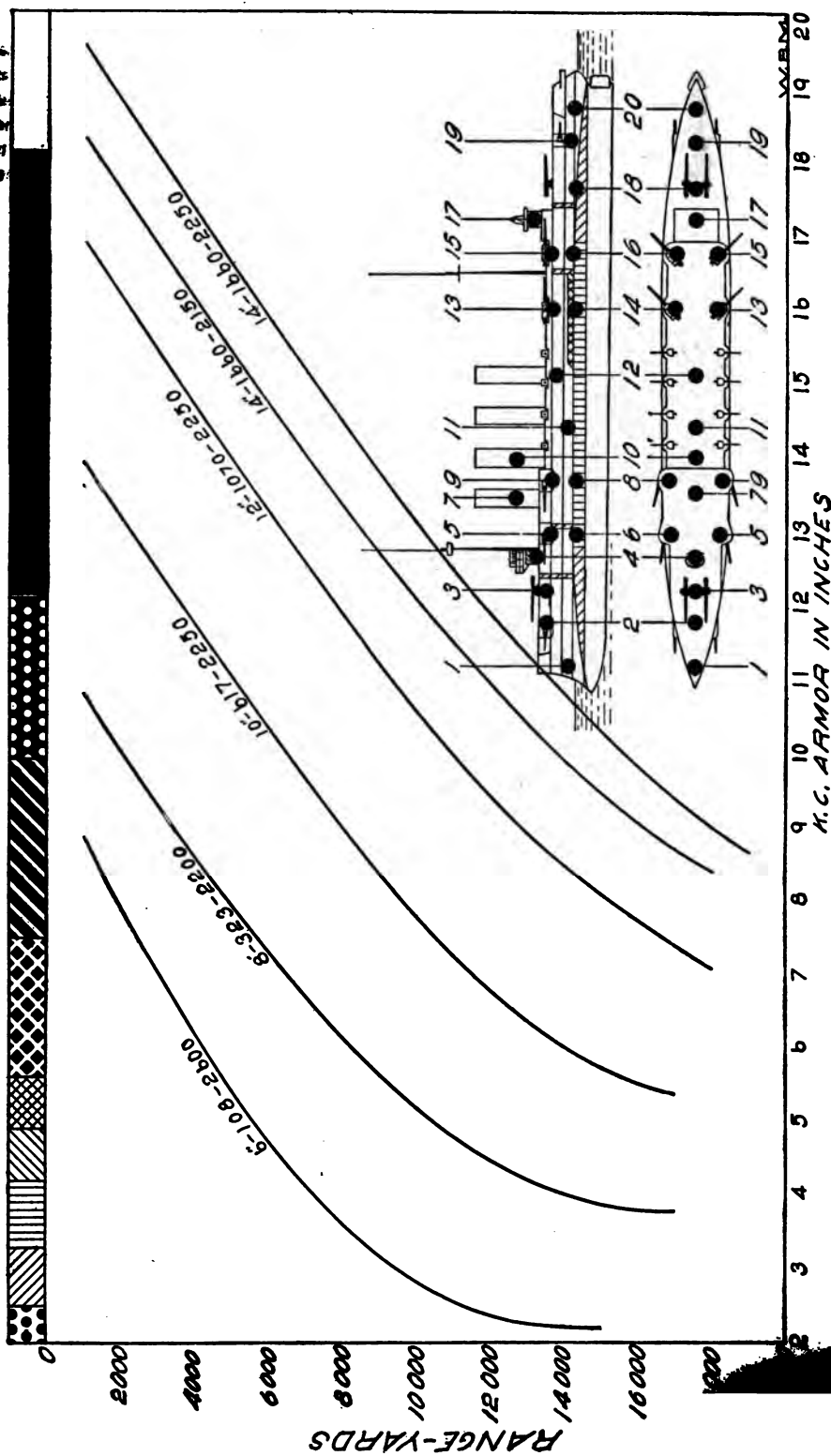


FIGURE 13.

COAST ARTILLERY WAR INSTRUCTION TYPE SHIPS

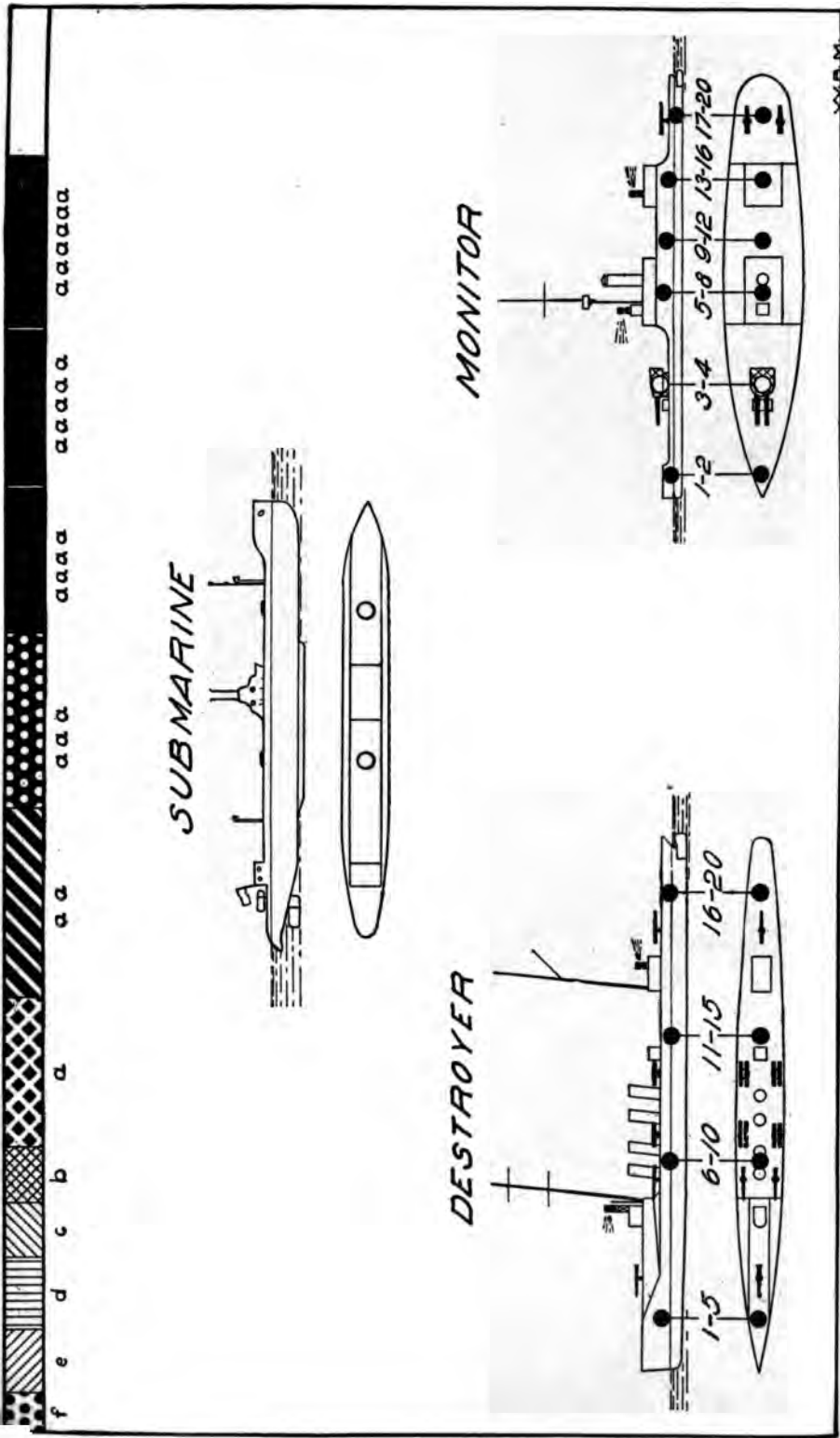


FIGURE 14.

It is advisable to select navies of one or more nations, as black, yellow, or red, and make several divisions of each class, as dreadnaughts, battleships, battle cruisers, armored cruisers, light cruisers, destroyers, submarines, colliers, and armed transports. In addition models should be made of the principle elements of the American Navy.

Ship cabinets.—A small cabinet, with lock and key, should be constructed for keeping the ship models. As the models are easily broken, and require considerable time and care to repair, when not in use they should be placed in their proper position in the cabinet and locked up.



FIGURE 15.—SHIP MODELS.

Hit bags for ships.—For purposes of scoring the effect of ship fire against the forts, hit bags for each class of ships are constructed, using the following tables of probabilities:

Probability of hitting.

DREADNAUGHT, BATTLESHIP, OR ARMORED CRUISER.

Range (yards).	Day firing.		Night firing.		Numbers on cubes.
	Per cent of hits.	Number of cubes.	Per cent of hits.	Number of cubes.	
2,000.....	90	15	70	20	2
3,000.....	75	25	50	15	3
4,000.....	50	17	35	12	4
5,000.....	33	11	23	10	5
6,000.....	22	7	13	4	6
7,000.....	15	5	9	4	7
8,000.....	10	4	5	3	8
9,000.....	6	2	2	2	9
10,000.....	4	2	.....	.....	10
11,000.....	2	1	.....	.....	11
12,000.....	1	0	.....	.....	12
13,000.....	1	0	.....	.....	13
14,000.....	0	0	.....	.....	14
15,000.....	1	1	.....	.....	15
		10		30	Misses.
Total.....		100		100	

CRUISER, GUNBOAT, DESTROYER, OR MONITOR.

2,000.....	50	8	51	20	2
3,000.....	42	12	31	15	3
4,000.....	30	15	16	7	4
5,000.....	15	9	9	5	5
6,000.....	6	2	4	2	6
7,000.....	4	2	2	1	7
8,000.....	2	0	1	1	8
9,000.....	1	1	.....	.....	9
10,000.....	1	1	.....	.....	10
		50		49	Misses.
Total.....		100		100	

Turning card and speed scale.—This card shows the track of a ship during one and two minutes. It should be made of heavy mounted drawing paper. It is made to the scale of the war-game board; 1 inch equals 100 yards.

The straight edge of the card represents the distance that a ship would travel on a straight course during *two* minutes, at a speed of 30 knots per hour. At speeds less than 30 knots, this distance is indicated by the underlined figures along the edge. These figures represent the speed of the ship in knots.

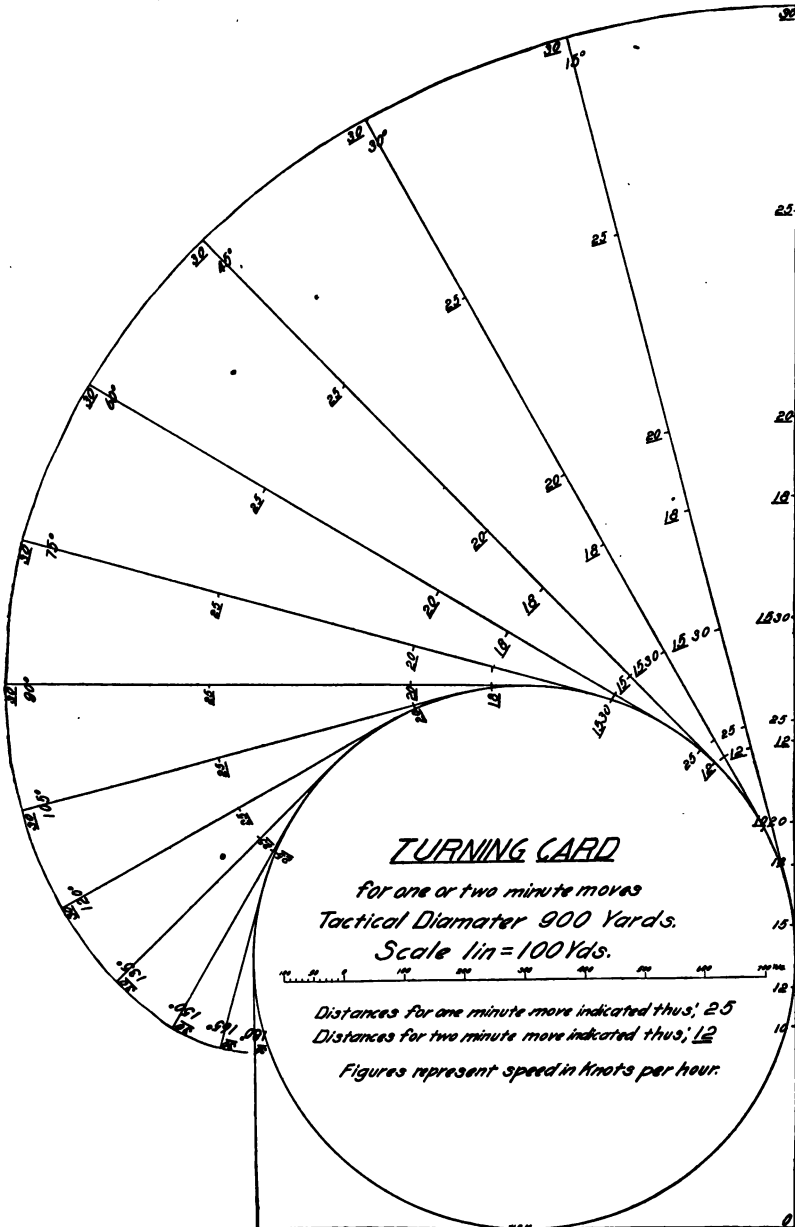


FIGURE 16.

The distance a ship would travel during *one* minute at various speeds are indicated by the figures not underlined.

The circle drawn on the turning card represents the turning circle of the ship, assuming a tactical diameter of 900 yards.

The lines tangent to the turning circle represent the path of a ship for changes of course ranging from 15 degrees to 180 degrees. These lines are numbered similarly to the straight edge of the card to represent the speed of the ship in knots.

In using the card, the straight edge is laid in the direction of the course at the beginning of the move, except in cases where the move is a continuation of a change begun in a previous move. In this latter case the movement continues from the point reached at the end of the previous move.

The straight edge of the card is also used as a speed scale on a straight course. (See fig. 16.)

The balopticon.—This projection machine consists of an arc lamp, lamp house, dark chamber, two condensing lenses, lantern-slide carrier, lantern-slide lens, opaque lens, and reflecting mirror. A stand, rheostat, and inclosed knife switch are provided. (Fig. 17.)



FIGURE 17.

The lamp is for 110 volt, alternating or direct current. It has a maximum capacity of 25 amperes and the connecting wire should be at least No. 10. If alternating current is used the upper and lower carbons should be the same size. If direct current, use large-size upper and small-size lower carbons. The arc is centered by two buttons at rear of the lamp house. Forward and backward movement is had by a button at side of lamp house. The carbons are fed by two buttons at the rear.

The balopticon will project either lantern slides or opaque objects. For lantern slides the lamp house should be horizontal. Opaque objects to be projected are placed at the bottom of the dark chamber, the lamp house is tilted to 45 degrees, and light is reflected from the object through the opaque lens to the mirror, thence to the screen.

One balopticon is issued to each post having a war-game installation; 200 carbons are issued with each instrument. Additional carbons can be had on requisition.

Lantern slides.—One hundred and eight lantern slides, contained in a suitable case, are issued with each balopticon. Additional slides will be issued from time to time as new ships are put in commission.

The following slides have been issued to date:

SAILING SHIPS.	FUEL SHIPS.	BATTLESHIPS.
1. Sloop.	41. U. S. S. Neptune.	75. U. S. S. Indiana.
2. Yawl.	42. U. S. S. Vulcan.	76. U. S. S. Iowa.
3. Ketch.		77. U. S. S. Kearsarge.
4. Two-masted schooner.	SUBMARINES.	78. U. S. S. Wisconsin.
5. Knockabout-rig fisherman.	43. U. S. submarine No. 1.	79. U. S. S. Ohio.
6. Three-masted schooner	44. British D-7.	80. U. S. S. New Jersey.
7. Four-masted schooner.	45. U. S. S. Narwhal.	81. U. S. S. Louisiana.
8. Six-masted schooner.	46. German D-1.	82. U. S. S. Mississippi.
9. Hermaphrodite brig.	TORPEDO BOATS.	83. U. S. S. New Hampshire.
10. Barkentine.	47. U. S. S. Mackenzie.	84. German Pommern.
11. Bark.	48. U. S. S. Stringham.	85. Austrian Hapsburg.
12. Four-masted bark.	49. U. S. S. Blakely.	86. Japanese Tango.
13. Full-rigged ship.	DESTROYERS.	87. Japanese Asahi.
LINERS.	50. U. S. S. Drayton.	88. Japanese Mikasa.
14. Leyland Line.	51. U. S. S. Cassin.	89. Japanese Tsukuba.
15. United Fruit Line.	52. U. S. S. Terry.	90. Japanese Ibuki.
16. American Line.	GUNBOATS.	BATTLE CRUISERS.
FREIGHTERS.	53. U. S. S. Dixie.	91. Japanese Satsuma.
17. Tramp Foyle.	54. U. S. S. Montgomery.	92. British Inflexible.
18. Tramp.	55. U. S. S. Dubuque.	93. German Von Der Tann.
19. Coal steamer.	56. U. S. S. Nashville.	94. Japanese Kongo.
20. Tank steamer.	57. U. S. S. Dolphin.	DREADNAUGHTS.
21. Whaleback barge.	58. U. S. S. Wilmington.	95. U. S. S. South Carolina.
22. Whaleback steamer.	LIGHT CRUISERS.	96. U. S. S. Delaware.
23. American lake steamer.	59. U. S. S. Salem.	97. U. S. S. Florida.
MISCELLANEOUS.	60. U. S. S. Cincinnati.	98. U. S. S. Wyoming.
24. Cable ship.	61. U. S. S. Des Moines.	99. U. S. S. New York.
25. Steam pilot boat.	62. U. S. S. Columbia.	100. U. S. S. Oklahoma.
26. Lighthouse tender.	63. U. S. S. Olympia.	101. German Westfalen.
27. Hedge Fence Lightship.	64. U. S. S. Saratoga.	102. British Temeraire.
28. Boston Lightship.	65. U. S. S. Brooklyn.	103. Argentine Rividavia.
29. U. S. A. T. Sedgwick.	66. U. S. S. Milwaukee.	BUOYS.
COAST GUARD CUTTERS.	67. German Victoria Louise.	104. Spar buoy.
30. Seneca.	68. Chinese Hai Chi.	105. Gas buoy.
31. Onondaga.	69. British Melpomene.	106. Bell buoy.
32. Seminole.	ARMORED CRUISERS.	107. Whistling buoy.
33. Thetis.	70. U. S. S. Colorado.	108. Combination gas and whistling buoy.
34. Pamlico.	71. U. S. S. Tennessee	
35. Tuscarora.	72. Japanese Idzumo.	
36. Itasca.	MONITORS.	
NAVAL SHIPS.	73. U. S. S. Amphitrite.	
37. U. S. S. Solace (hospital ship).	74. U. S. S. Tonopah.	
38. U. S. S. Prairie.		
39. U. S. S. Mayflower.		
40. Fleet off Hampton Roads.		

CHAPTER II

BATTERY, FIRE, AND FORT COMMANDER'S COURSES.

The Coast Artillery war instruction is divided into two kinds, as follows:

First, that which relates to the method of using the apparatus, giving the correct commands, indicating and identifying targets, and handling of searchlights.

Second, that which relates to the tactical method of handling the various elements of the defense so as to meet various naval attacks.

The first kind of instruction should be given to both officers and men, while the second kind is limited to the commissioned officers.

The various courses, outlined in General Orders, No. 12, War Department, 1914, are as follows:

(a) For battery officers, observers, gun pointers, and telephone operators, to be conducted by the battery commander, under supervision of the fire commander, to include the following: Use of proper and uniform commands, rapid indication and identification of targets, armor and its attack, best tactical use of battery when "Battery commander's action" is ordered, use of emergency conditions, etc.

(b) For fire and battery commanders, to be conducted by the fire commander, under supervision of fort commanders, to include use of proper and uniform commands, rapid indication and identification of targets, fire-command drill, armor and its attack, tactical use of elements of the defense (i. e., guns, searchlights, and submarine mines), type forms of attack for each harbor, with best method of meeting the same, etc.

(c) For fort, fire, and battery commanders, to be conducted by fort commanders, under supervision of coast-defense commanders, to include use of proper and uniform commands, rapid indication and identification of targets, fort-command drill, tactical use of the elements of the defense, estimating the situation, etc.

BATTERY COMMANDER'S COURSE.

For battery officers, observers, gun pointers, and telephone operators, to be conducted by the battery commanders, under supervision of the fire commanders, to include the following: Use of proper and uniform commands, rapid indication and identification of targets, armor and its attack, best tactical use of battery when "Battery commander's action" is ordered, use of emergency conditions, etc. (See G. O., 12, W. D., 1914.) In addition to the foregoing, the following should also attend: Plotters, gun commanders, candidates for rated positions, and other specially selected enlisted men.

One hour daily four days a week during the period of indoor instruction, and on such other occasions as climatic conditions render desirable.

FIRST WEEK.

First 15 minutes: Balopticon, Characteristics of warships.

Remainder of hour: Indication and identification of targets.

SECOND WEEK.

First 15 minutes: Balopticon, Characteristics of warships.

Remainder of hour: Location of elements of defense.

Hydrography of harbor.

Estimation of ranges.

Indication and identification of targets.

THIRD WEEK.

First 15 minutes: Balopticon, Characteristics of warships.
 Remainder of hour: Emergency conditions.
 Armor and its attack.
 Telephone drill.

FOURTH WEEK.

First 15 minutes: Balopticon, Characteristics of warships.
 Remainder of hour: Searchlight drill.
 Telephone drill.
 Battery commander's action.

I. BALOPTICON.

Characteristics of Warships.—The object of this training is to cultivate the powers of observation, and to enable various types of warships to be easily described and recognized.

The instruction should be systematic and progressive. On the first day silhouettes of simple types should be thrown on the screen and the characteristic features, such as masts, funnels, turrets, etc., pointed out and each member should draw a sketch of the silhouette, under the direction of the instructor, thus gaining familiarity with the conventional signs for indication of a turret, mast, gun, funnel, etc. When these are understood, pictures should be thrown on the screen for about 60 seconds, during which time the instructor calls attention to the important characteristics. After 60 seconds the picture is taken off, and each member is required to draw a sketch of the vessel from memory. At the beginning this may seem a little difficult to some men, who have no ability to draw. It should be borne in mind, however, that only a very moderate ability to draw is necessary, and that even this can be cultivated. Not more than six sketches should be drawn in any one session, and the remainder of the time devoted to oral description by members of the section.

The following schedule gives the silhouettes and pictures which should be used each day in a progressive course:

FIRST WEEK.

FIRST DAY.	SECOND DAY.	THIRD DAY.	FOURTH DAY.
Sloop.	Full-rigged ship.	Four-masted bark.	U. S. S. Itasca.
Two-masted schooner.	Two-masted schooner.	Whaleback steamer.	German D-1.
Bark.	Whaleback steamer.	U. S. S. Mayflower.	U. S. S. Vulcan.
Barkentine.	U. S. S. Tuscarora.	U. S. S. Terry.	U. S. S. Tennessee.
Full-rigged ship.	U. S. S. Prairie.	U. S. S. Salem.	U. S. S. Louisiana.
U. S. S. Seneca.	U. S. S. Cassin.	U. S. S. Des Moines.	German Von Der Tann.
U. S. S. Mayflower.	U. S. S. Mackenzie.	Japanese Idzumo.	U. S. S. Delaware.
U. S. submarine No. 1.	U. S. S. Salem.	U. S. S. Mackenzie.	Spar buoy.
U. S. S. Drayton.	U. S. S. Brooklyn.	Japanese Asahi.	Gas buoy.
U. S. S. Nashville.	U. S. S. Solace (hospital ship).	Japanese Kongo.	Bell buoy.

SECOND WEEK.

FIRST DAY.	SECOND DAY.	THIRD DAY.	FOURTH DAY.
U. S. S. Mayflower.	Tank steamer.	Coal steamer.	Barkentine.
U. S. S. Stringham.	U. S. S. Prairie.	Boston Lightship.	Cable ship.
Japanese Satsuma.	U. S. S. Mayflower.	U. S. S. Wilmington.	U. S. S. Pamlico.
U. S. S. New York.	U. S. S. Pamlico.	U. S. S. Salem.	Austrian Habsburg.
U. S. S. Tennessee.	British Temeraire.	U. S. S. Cassin.	British Inflexible.
German Westfalen.	U. S. S. New York.	U. S. S. New York.	U. S. S. Wyoming.
Japanese Kongo.	Whistling buoy.	U. S. S. Wyoming.	U. S. S. New York.
Austrian Habsburg.	U. S. S. Wilmington.	U. S. S. Louisiana.	Japanese Kongo.
U. S. S. Ohio.	U. S. S. Terry.	U. S. S. New Jersey.	Japanese Satsuma.
Japanese Idzumo.	U. S. S. Blakely.	German D-1.	Combination gas and whistling buoy.

THIRD WEEK.

FIRST DAY.	SECOND DAY.	THIRD DAY.	FOURTH DAY.
American lake steamer.	U. S. S. Milwaukee.	U. S. S. Wyoming.	U. S. S. Tonopah.
Steam pilot boat.	U. S. S. Tennessee.	Japanese Kongo.	U. S. S. Tennessee.
Chinese Hai Chi.	U. S. S. Tonopah.	U. S. S. Terry.	U. S. S. Columbia.
U. S. S. New Hampshire.	U. S. S. Seneca.	U. S. S. Stringham.	U. S. S. Vulcan.
German Von Der Tann.	U. S. S. Vulcan.	U. S. S. Narwhal.	U. S. S. Mayflower.
U. S. S. New York.	Hedge Fence Lightship.	U. S. S. Saratoga.	Japanese Tango.
Japanese Kongo.	American lake steamer.	U. S. S. Salem.	U. S. S. Milwaukee.
U. S. S. Wyoming.	American Line.	U. S. S. Tonopah.	U. S. S. Florida.
U. S. S. Tonopah.	Hermaphrodite brig.	U. S. S. Solace (hospital ship).	U. S. S. Tuscarora.
Japanese Idzumo.	Spar buoy.	Whistling buoy.	Combination gas and whistling buoy.

As the instruction proceeds and the section becomes familiar with the different types, the drawing feature of the instruction can be gradually eliminated, and the instructor should question members of the section as to the class and size of the vessels, kind of masts (military, pole, fire-control, etc.), size of guns, number and location of turrets, number of searchlights, thickness of armor, nationality, etc.

As an example, when the screen shows the picture of a tank steamer, the instructor would ask the following questions, each to a different member of the section: Class? 1-3. Type? Oil-tank. Where is pilot house? Forward on forecastle. Where is engine room? In the stern. What is probable speed? Ten knots. What is the tonnage? About 3,000 tons. What is aiming point? Funnel.

When a picture of *Wyoming* is on screen (slide 98): What class? 2-2. How many turrets? Five. What is caliber of turret guns? Twelve-inch. Thickness of belt? Nine inches thick. Turrets? Sixteen inches thick. Where is conning tower? Near base of foremast. What kind of masts? Fire-control. At anchor or under way? Under way. Nationality? American. What class? Dreadnaught. Name? *Wyoming*. Maximum draft? Twenty-six feet. Displacement? About 30,000 tons. Speed? About 22 knots. What is aiming point? Forward funnel.

II. INDICATION AND IDENTIFICATION OF TARGETS.

A picture is thrown on the screen, and the instructor calls at random upon any member of the section to indicate the vessel as a target, giving description and using proper commands.

Example.—Slide 81, U. S. S. *Louisiana* on the screen. Instructor points to Corpl. A. to assign same as a target as if he were battery commander.

Assignment.—Target, Allerton; Battleship going north; Class, 3-2; B' vertical base; Track.

The instructor then calls on Sergt. X. "B' describe."

Description.—Battleship going north; Class, 3-2; Two fire-control masts; One turret forward; One turret aft; *Louisiana*.

At first it may be necessary for the instructor to give the commands and have the members repeat them after him, but in a short time this will be unnecessary.

This is followed by a course using models of various sailing vessels and commercial steamers placed on the board in the different water areas. Two or more azimuth instruments are set up in the room, and the observers at them, as well as the remainder of the section (equipped with Signal Corps field glasses), are required to select the target assigned from the description given by the instructor.

FIRST EXAMPLE.

On the war-game board are placed several models of tramp steamers, sailing vessels, and commercial liners. The instructor gives the following command: "Target, Graves; Tramp steamer, going south; Class, 1-2; Black hull, white upper works, black funnel with red band." Then he points to any member of the section or calls on one of the observers to identify the target. There may be several tramp steamers

in this one water area, and it will be found necessary for the instructor to point out some one characteristic that will differentiate it from all others therein, and the members of the section should be able to quickly locate the one referred to.

After the section has become familiar with the various commercial vessels, models of war vessels, such as battle cruisers, dreadnaughts, battleships, armored cruisers, protected cruisers, destroyers, and scouts, are placed on the board in different formations (line abreast, line ahead, double column). Targets are then assigned, as follows:

Example.—Target, Black Rock; Destroyer division, double column; Starboard column; Ship No. 1; Emergency system; Track.

Care should be taken that all observers and gun pointers select observing and aiming points, as follows:

1. For all power vessels having but one funnel, that funnel will be the observing and aiming point.

2. For all sailing vessels having but one mast, that mast will be used for the observing and aiming point.

3. For all power vessels having two or more funnels, the forward funnel will be the observing and aiming point.

4. For all sailing vessels having two or more masts, the forward mast will be the observing point.

5. For all vessels not included above, the aiming point will be designated by the commander assigning the target.

If for any reason it is impracticable to utilize the observing and aiming points specified above, the battery commander will designate other points when he indicates the target, or at any time after he indicates the target that it becomes impracticable to use the prescribed points. (See par. 79, D. R. C. A.)

III. LOCATION OF ELEMENTS OF THE DEFENSE.

This instruction is given at the war-game board and consists in pointing out to the section the location of the various batteries, range stations, location and tactical number of the searchlights, and the supporting relations of the various forts.

IV. HYDROGRAPHY OF THE HARBOR.

At the war-game board, the various navigable channels, lighthouses, channel marks, shoals, reefs, and water areas are pointed out to the section, and questions are asked as to the possible courses of approach for various types of vessels. The instruction should include the following:

1. Name, location, kind, radius of illumination, and range to each lighthouse.

2. Name, location, and range to datum points, buoys, or other channel marks.

3. General direction, name, width, and depth of channel, with a statement of what classes of war vessels can navigate same.

4. Name and location of shoals, and ranges thereto.

5. Names and location of subareas. (See par. 302, D. R. C. A.)

6. Location, numerical designation, size, and approximate range of beam of all searchlights of the coast-defense command.

7. Ranges to all prominent points and landmarks along the shore.

8. Location of, ranges to, and general features of all practicable landing places for bodies of troops.

V. ESTIMATION OF RANGES.

Using the war-game board, members of the section are required to estimate ranges to all important points in the harbor, remembering that the scale of the board is 1 inch equals 100 yards. For example, if a certain lighthouse appears to be 5 feet from a given battery, it is actually 6,000 yards.

The ranges to various ship models placed on the board can be estimated very closely by comparison with the distance to known points, such as buoys, lighthouses, prominent land features, etc. Questions as to whether it is possible for a certain stated battery to fire on a designated ship will not only bring out the question as to range of the target, but also the maximum range of the different calibers of guns.

VI. EMERGENCY SYSTEM.

Paragraph 56, Drill Regulations for Coast Artillery, requires that emergency conditions shall be practiced. Such practice is most important since the fire of the battery may cease or be seriously reduced unless the battery commander can promptly meet, during an action, damages to the fire-control equipment or lines of communication.

The instruction consists of having the instructor assess damages such as the following:

- (a) Elimination of primary station only;
- (b) Elimination of secondary station only;
- (c) Elimination of battery commander's station only;
- (d) Elimination of primary and secondary;
- (e) Elimination of primary and battery commander's station;
- (f) Elimination of battery commander's station and secondary;
- (g) Elimination of sight standard and gun pointer;

and requiring that the proper commands be promptly given to meet the assumed damage by making such disposition as will best meet the emergency.

For example, if the battery be tracking a given target by horizontal base, and the secondary station is declared out by the instructor, the battery commander may then decide to change to vertical base, and will order "B' Vertical base, Track." Similarly at a gun battery, if sight standard is destroyed, the command for case III would be required.

It will be remembered that in time of action more or less confusion must be expected, and it is necessary to have orders given in the fewest possible words consistent with a proper understanding of what is desired. A telephone operator can more readily distinguish a command with which he is familiar, and great care should be exercised in framing short commands that meet all probable emergency conditions.

VII. ARMOR AND ITS ATTACK.

It is essential that not only the officers but the enlisted personnel assigned to each battery should have a general idea of the armor and its location on the various types of war vessels. Having such a general knowledge, it is then possible to determine the proper kind of projectile to be used.

Slides of the different types of vessels are thrown on the screen and the section questioned as to the thickness of armor amidship, on turrets, protective deck, etc. After consulting the penetration curves the members are then questioned as to whether it is possible to penetrate with the various calibers at the stated ranges. In this manner a knowledge is soon acquired of the ranges at which dreadnaughts, armored cruisers, etc., can be effectively attacked by the various types of guns.

Example.—Slide 94, Japanese battle cruiser *Kongo* thrown on screen: What is thickness of armor in belt, amidship? About 10 inches. At ends? Four inches. Deck? Three inches. Turrets? Ten inches. Extreme range at which belt would be perforated? Eight thousand yards with normal impact. What is aiming point? Forward funnel.

VIII. TELEPHONE DRILL.

Poorly trained telephone operators are a cause of unnecessary troubles. In many instances it is not so much the operator's fault as it is that the commands are badly given or that unnecessary or illy chosen messages, involving words which are difficult

of transmission by telephone, are sent. All commands should be given clearly, distinctly, unhesitatingly, and as fast as is consistent with proper repetition by telephone. The following examples are a few of the many that will be used by a battery commander. If they are given by the instructor and the various members of the section be required to repeat after him, uniformity of commands will be obtained.

The battery commander having identified a target, indicated to him by the fire commander, will indicate it to his observers (at B', B'', and E) and gun pointers as follows:

Target, subarea, name (or type and class) of an isolated ship, or designation of division, formation, ship number, and at night the number or name of the covering searchlight. When the observers are on the target they report "B" (B''' or emergency) on target." When the gun pointers are on the target they repeat "No. 1, 2, 3, or 4 on target." When the battery commander is satisfied that the target has been correctly identified by the observers he will give the command, "Track." Unless otherwise specified, the system normally used at the battery will be used at the command "Track." Dashes in commands indicate pauses to allow for transmission of the command by telephone.

BATTERY COMMANDER TO BASE END STATIONS.

Target—Allerton—Battle cruiser division, line ahead—Ship No. 1 (B' on target; B'' on target; B''' on target; Emergency on target)—Track.

TO CHANGE BASE.

B'—Vertical base—Track.	B'—Auxiliary base—Track.
B''—Vertical base—Track.	B''—Auxiliary base—Track.
B'''—Vertical base—Track.	B'''—Auxiliary base—Track.
Horizontal base—Track.	
B'—Vertical base—Track.	
B'''—Vertical base—Track	

TO DETERMINE IF OBSERVERS ARE ON PROPER TARGET.

B'—Describe.	B'''—Describe.
B''—Describe.	Emergency—Describe.

IF DESCRIPTION IS SATISFACTORY, FIRE OR BATTERY COMMANDER ADDS.

B'—On target.	B'''—On target.
B''—On target.	Emergency—On target.

BATTERY COMMANDS.

Target—Allerton—Armored cruiser division, line ahead—Ship No. 2 (B', B'', B''', Emergency, on target)—Track.

Target—Main—Gunboat division, line ahead—Ship No. 3—Track.

Target—Black Rock—Anderson division—Target No. 1—B''' Vertical base, Track.

Target—Broad—Coal barge division going out—Ship No. 1 (this means observe on tug)—Emergency system, Track.

Target—Broad—Coal barge division going out—Barge No. 1—B' Auxiliary base, Track.

Target—Allerton—Tramp steamer, class 2-2, coming in—B''' Auxiliary base, Track.

Target—Broad—Dreadnaught division, line abreast—Ship No. 1—With A. P. shot—Battery load—Commence firing.

Target—Allerton—Battleship division, line ahead—Ship No. 3—Track—With A. P. shell—Fire four rounds—Commence firing.

Target—Fixed target—Boston Light—B' Report range—B'' Report range.

Target—Graves—Brooklyn—Track.

Target—Graves—Battleship, class 2-2—Track.

Target—Broad—Battle cruiser division, line ahead—Ship No. 1—B' Vertical base Track.

Target—Allerton—Destroyer division, double column, starboard column—Ship No. 1—Emergency system, Track.

Change target—Target—Main—Submarine awash—B'' Vertical base, Track.

With A. P. shot—Fire three rounds—Commence firing.

With A. P. shell, No. 1 fire 2 shots—Commence firing.

With D. P. shell, fire two pit salvos—Commence firing.

With D. P. shell, fire four rounds—Commence firing.

Plotting room—Report range.

F₂—Range to target, 6,000 yards.

Plotting room—Report cause of delay. } Types of short messages.

Plotting room—Range officer to phone. }

Plotting room—Report time of flight. }

A to phone—Report cause of delay (A, name of emplacement officer).

B to phone—Report cause of misfire.

SEARCHLIGHT COMMANDS.

10 In action.	7 Uncover and cover 10.
10 Search. (This command signifies that No. 10 light will search the fire area assigned to it.)	1 Uncover and search.
	1 Uncover and search Allerton.
10 Search main. (This means that No. 10 will search the subarea, Main.)	1 Follow.
10 Follow. (This means that the searchlight is to follow target even if target moves out of subarea assigned to light.)	1 Left—halt.
	1 Left—slightly.
7 Cover 10.	5 Azimuth 285.
	5 Elevate.
	5 Lower.
	5 Spread.
	5 Focus.

IX. BATTERY COMMANDER'S ACTION.

This class of instruction should be given at the war-game board by the instructor imposing penalties on the shore defenses or after arranging the attacking fleet in such a way that the battery commander must act after considering the various conditions which follow:

During the last stages of an action which has been pressed to short range when the forts have suffered damage in both personnel and matériel or during the last stages of a run-by when all fire-control equipment has come under the devastating effect of the fleet's rapid-fire armament, it may be necessary for the fire commander to place the control entirely in the hands of the battery commander. Similar conditions may result earlier in the action by the destruction of all communications between the battery commander and higher authority.

Paragraph 54, Drill Regulations for Coast Artillery, recognizes such contingencies and provides certain courses of action.

Upon the receipt of the order "Battery Commander's Action", the commander must rapidly estimate the existing situation and promptly form his decision. In so doing he must consider in sequence the following:

- (a) Previous instructions.
- (b) Available targets.
- (c) Angle of presentation and probability of hitting.
(Zone in case of mortar fire.)
- (d) Arc of fire of battery.
- (e) Which ship is most menacing to the defense.
- (f) Location of mine fields and other batteries.

(a) *Previous instructions.*—Before acting on his own responsibility, the battery commander should carefully consider instructions previously given by the fire and other superior commanders with reference to existing conditions.

(b) *Possible available targets.*—The target selected should be appropriate to the caliber of the battery. Only in exceptional cases should it be expected that minor or intermediate batteries could have any appreciable effect upon capital ships. Their proper objectives would be cruisers, destroyers, or submarines.

(c) *The angle of presentation* will be important if the gun be matched by the armor or if the courses of the target be such as to seriously effect by its great speed the probable error in deflection. In case of mortars the dead space (within zone 1) and the angle of passage through the zones is important.

(d) *Arc of fire.*—The arc of fire of the battery will decide the possibility of using one or more guns.

(e) *The most menacing ship.*—This will be usually most apparent by the damage resulting from ships' fire.

(f) *Location of mine field and other batteries.*—These considerations may cause the battery commander to decide to leave certain ships to be dealt with by mines or by other batteries and to concentrate fire on a particular target.

Having rapidly made his estimate the battery commander selects his target and, using his emergency equipment (see par. 55, D. R. C. A.), gives orders for firing.

FIRE COMMANDER'S COURSE.

For fire and battery commanders, to be conducted by the fire commander, under supervision of fort commander, to include use of proper and uniform commands, rapid indication and identification of targets, fire command drill, armor and its attack, tactical use of elements of the defense (i. e., guns, searchlights, and submarine mines), type forms of attack for each harbor, with best methods of meeting the same, etc.

As it is essential that all officers should be thoroughly familiar with the subject matter of the battery commanders' course, they should complete the instruction therein indicated before commencing with the fire commanders' course.

I. PROPER AND UNIFORM COMMANDS.

This instruction should begin with the use of the balopticon. Pictures are thrown on the screen and the fire commander directs Capt. X. to assign the indicated target.

Example.—When screen shows U. S. S. *Cassin* (slide 51), fire commander points to Capt. X., who then says: "Target—Allerton—Destroyer division, line ahead, going north (formation and direction being assumed at random, since picture shows but a single destroyer)—Ship No. 3—Track," or "Plunkett—Target—Allerton—Destroyer division, line ahead, coming in—Ship No. 3—No. 1, Fire one shot—Commence firing."

Or when screen shows U. S. S. *New Hampshire* (slide 83): "Target—Graves—Battle-ship division, line abreast, coming in—Ship No. 2 (formation assumed since photograph but a single ship), B' Vertical base—Track—B' Describe." (B' replies: Graves—Battle-ship division, coming in, ship No. 3, class 2-3.) "Change target—Same division, ship No. 2—Whitman—Fire four pit salvos—Commence firing." Other commands simulating the conditions of an action can be given.

This practice should be continued until all officers can give commands without the slightest hesitation. The instruction should then be continued by placing models on the war-game board.

II. FIRE COMMAND DRILL.

This instruction is given at the war-game board. Each officer takes his designated station. If a night drill is intended the searchlight operators should be at the controllers of the miniature searchlights. In the immediate vicinity of the fire commander should stand the telephone operator from fire commander to the battery commanders.

Similarly near each battery commander should stand the telephone operator from battery commander to battery. Two azimuth instruments should be set up near the end of the room with an observer at each. On the board in the various subareas of the battle area should be placed models of various commercial craft peculiar to the harbor as well as a few naval targets. At the beginning it is best to have but few models until the procedure is thoroughly understood.

The fire commander should then conduct a fire command drill, using the telephone operators to transmit messages and orders from his station to battery commanders (and searchlights if a night drill) and from battery commanders to battery and observers.

The following outline is suggested:

Fire commander commands: "All batteries report" (repeated by fire commander's telephone operator).

Commanding Officer Whitman reports: "Whitman in order" (repeated by Whitman's operator to fire commander's operator, who repeats the order to fire commander).

Commanding Officer Cushing reports: "Cushing in order," similarly repeated to fire commander; and in succession each battery and searchlight reports.

Fire commander then commands: "All batteries prepare to take time 10.10" (repeated by telephone operators to battery commanders, who prepare to synchronize their watches with that of fire commander)—"10 seconds, 5 seconds—Take" (the latter command being given at the proper instant).

The fire commander, desiring to assign a tramp steamer coming in main channel to Whitman, orders: "Whitman—Target—Main—Tramp steamer, coming in—Class 1-2—Report range at 10.25." This command being transmitted to battery commander, that officer gives proper commands for tracking, and the two observers at the azimuth instruments select the target indicated. The battery commander after estimating the range (or an assistant to the umpire can measure it if considered necessary), reports back at the proper time to the fire commander as follows: "F₃ range 4,400 yards at 10.25."

In a similar manner the drill should proceed employing other commands appropriate to the situation on the board.

After the routine of day drill is understood and can be conducted without confusion or unnecessary interruption, night drill employing the searchlights should be tried.

III. ARMOR AND ITS ATTACK.

This instruction is begun by employing the pictures thrown on the screen, the instructor asking individual officers questions as to the location, kind, and thickness of armor on various positions of typical warships. The officers should be encouraged to look up in Jane's Fighting Ships for such information as may be necessary. It must be borne in mind that the penetration obtained from the penetration curves is for a 60-degree angle of impact.

IV. TACTICAL USE OF ELEMENTS OF THE DEFENSE.

This instruction is given at the war-game board and consists in a tactical study by the fire and battery commanders as to the best method of employing the elements of the defense to meet various attacks. It involves the mutually supporting relations which may be expected of each battery, the batteries best adapted to attacking various types of ships, and a consideration of the armor and angle of presentation of various possible targets, the cooperation between guns and mine fields, a careful consideration of the field of fire of each battery, the particular battery or base line best suited to attack a given target, the best searchlights for use in certain given circumstances for illuminating and searching lights, the location and organization of the Coast Artillery supports, the emergency stations to be employed to control fire of secondary armament in attack by land, etc.

V. TYPE FORM OF ATTACK WITH BEST WAY OF MEETING SAME.

This instruction is given at the war-game board. Using the different types of warships, each of the type forms of attack should be rehearsed until they are familiar to all. The instruction should begin with day phases, and, in succession, the different forms of reconnaissance, raids, blockades, bombardments, blocking-channel attempts, and run-bys should be employed. After the different forms of day attacks are thoroughly understood and quickly recognized, the same should be repeated in night phases employing the searchlights.

The instruction should now proceed along the lines of deciding the method of meeting each type form of attack, with the best tactical assignment of each element of the defense. For the night phases it is often a complicated question to determine as to the proper assignment and use of the searchlights. This instruction should be coordinated with such night drills as may be practicable in the coast-defense command. Using models of such craft as may be available for night drill, the drill can be rehearsed at the war-game board with profit to all concerned. Such instruction will be of great assistance in estimating the situation for any given attack.

FORT COMMANDER'S COURSE.

For fort, fire, and battery commanders, to be conducted by fort commanders under supervision of coast-defense commanders, to include use of proper and uniform commands, rapid indication and identification of targets, fort-command drill, tactical use of the elements of the defense, estimating the situation, etc.

I. USE OF PROPER AND UNIFORM COMMANDS.

This instruction has been covered under similar headings in the battery and fire commander's courses. It need only be added that as many of the telephone operators as possible should be present, and great stress should be laid on the transmission of such messages as are liable to be used in drill or action.

II. INDICATION AND IDENTIFICATION OF TARGETS.

This instruction has been outlined in the battery and fire commander's courses. A greater variety of models should be employed than in either of the preceding courses.

III. FORT-COMMAND DRILL.

This is conducted on lines similar to the fire-command drill, the fort commander deciding upon the sequence in which orders should be given by fire, mine, and battery commanders. To avoid confusion the following sequence is suggested:

After all battery, fire, and mine commanders have reported, the fort commander gives such orders as he may desire to F_1 ; F_1 then gives the necessary orders to Batteries A, B, C, D. When he has completed, the commanding officer, Battery A, gives his orders and at the conclusion raps on the desk to indicate the conclusion. Similarly for commanding officer, Batteries B, C, and D. The fort commander then gives his commands for F_2 , and so on.

IV. TACTICAL USE OF ELEMENTS OF THE DEFENSE.

Paragraph 289, Drill Regulations for Coast Artillery, requires that—

He (the fort commander) will study the battle area, and will consider the location and strength of the elements of the defense under his command, and will rehearse the forms of attack liable to be adopted by an enemy. While it is not practicable to anticipate all of the conditions of attack that may arise during an engagement, nor all of the methods of attack that may be employed by an adversary of initiative and resource, there are certain type forms which may be anticipated and which will be frequently rehearsed.

This subject involves the best combination of the guns, mortars, mine fields, and searchlights in any tactical situation which may be assumed. It is one of great importance, and in many coast-defense commands the war-game board furnishes the only means of studying it. Joint maneuvers with the Navy have been most valuable in developing the tactics of coast defense, but it is seldom that they can be held, and at best the opportunities of any phase are but limited and mistakes made can not be remedied before their conclusion.

In this instruction a general situation involving a naval attack on the coast-defense command should be assumed, and different phases involving attacks by various types of naval vessels be prepared. No fixed rules can be given, but each coast defense must be studied first on the war-game board and later at drill.

Artillery Notes No. 37, Digest of Reports, Joint Naval and Coast Defense Exercises, August 3-9, 1913, contains much useful information as a guide in preparing orders for different phases.

Cooperation of the fort commanders with the coast-defense commander is necessary to a proper defense of any harbor. It is therefore necessary to have an exchange of ideas on the various points that may develop during the attack by a hostile fleet. It is realized that it is an impossibility to imagine all the contingencies that may arise, but, by carefully playing a game where it is assumed that a naval attack is being made on the harbor, many of the points can be cleared up. These points should be brought out at this time, and a clear understanding on the part of the fort commanders as to the wishes and plans of the coast-defense commander will save time and confusion in time of action. There will be many questions that must of necessity be decided by the coast-defense commander on the spur of the moment, and if by drill, exchange of ideas, and an agreed policy the number of these questions submitted for decision can be lessened, the efficiency of each fort is increased that amount.

CHAPTER III.

METHOD OF CONDUCTING THE GAME.

Object of instruction.—It is most important that all officers participating in the Coast Artillery War Game should thoroughly understand the purpose and object of the instruction, and particularly that no claim is made that by means of the apparatus provided it is possible to definitely decide the result of an engagement between ships and forts. The methods of scoring gunfire are merely contributory to the general development of the action, indicating relative weaknesses of the attack and defense.

In framing these rules it has been the endeavor to avoid as far as possible fixed and complicated rules, which are usually fatal to the development of any war game. All discussions, questions in dispute, and damages resulting from gunfire should be settled by the umpire, whose decisions are final.

Arrangement of room.—The general arrangement and matériel is shown in figure 4.

Umpire.—The game is conducted by the umpire, who has general charge, deciding all questions at issue, as well as the effect of gunfire. He is assisted by one or more assistants, who draw the curtain at the termination of each move, who keep the range board posted, and spin localizers.

Moves.—Each move represents one minute, and at its conclusion and after the curtain has been drawn the ship models should be moved accordingly.

At the end of each move the attendant draws the curtain, advances by one number the master clock, and spins the localizers (both for ships and forts). The umpire, before the first move, should assign to each battery and to each ship a pointer on the proper localizer.

Orders.—Before the commencement of the exercises a general and special situation should have been prepared by the umpire and issued to all concerned.

The officer in charge of the attack, assisted by one or more officers, should be required to prepare in advance his plan of attack, accompanied by a sketch showing the movements of each group of ships. He should write the orders necessary for the phase. The mission of the fleet should be clearly stated. Artillery Notes No. 37, Digest of Reports, Joint Naval and Coast Defense Exercises, will serve as a guide in drawing up the fleet orders.

The umpire announces the state of the wind, weather, tide, and the maximum searchlight range for the phase, if a night engagement is contemplated.

Placing models on board.—For a day phase, the ships should be placed on the board in the desired formation, at or beyond maximum range of the shore guns, or at the maximum range of visibility in case of haze, fog, or rain. One officer should be in charge of each group of ships, who should be required by the umpire to rigidly follow his written orders.

For a night phase, no models should be placed on the board until the conclusion of the third move. For the fourth move, such ships as are within the maximum searchlight range for the atmospheric conditions assumed should be put on the board—the other ships are put on the board in subsequent moves as they become visible.

Opening move.—The exercise opens by the coast-defense commander calling the players to "Attention" and ordering: "Andrews, report" (repeated by coast-defense commander's telephone operator and by fort commander's telephone operator at Fort Andrews). The fort commander, Fort Andrews, orders: "Whitman, report"

(repeated by fort commander's telephone operator and battery commander's telephone operator). The battery commander replies: "Whitman in order" (repeated by his telephone operator and fort commander's telephone operator). This reply means that the commander of Battery Whitman has the following articles:

One pair field glasses.

One pencil.

One hit bag (day or night).

One set of score cards, consisting of battle cruiser, dreadnaught, battleship, armored cruiser, light cruiser, monitor, destroyer, and submarine.

After "Whitman" has reported, each battery commander at the fort reports to his fort commander. The fort commander then calls on each searchlight to report; as, "5, report." The operator at the controller replies: "5 in order," meaning thereby that he knows the number of his light and that it is in order. In cases where the batteries are grouped into fire commands, the fort commander calls upon the fire commander to report, and the latter calls upon his battery commanders; as, "F₂, report," etc.

When all batteries, searchlights, fire, and mine commanders have reported in succession to the fort commander, that officer reports to his coast-defense commander: as, "Andrews in order." In a similar manner the coast-defense commander calls upon each fort in turn to report.

When all forts have reported in order, the coast-defense commander raps on his desk as a signal to the umpire he is ready to proceed.

The umpire then reads the general and special situation and signals for the attendant to draw the curtain, who then sets the master clock at one. After the curtain has been drawn if the engagement be a day phase, the coast-defense commander should carefully study the approaching ships and estimate the situation, as is described in a succeeding chapter. Having done this, he forms his decision and issues his orders.

Sequence of orders.—To avoid confusion, the orders should be given in the following sequence:

- (1) Coast defense commander.
- (2) Fort commander, Fort A.
- (3) Fire commander, first fire command, Fort A.
- (4) Battery commander, Battery A.
Battery commander, Battery B.
Battery commander, Battery C.
Battery commander, Battery D.
- (5) Fire commander, second fire command, Fort A.
Battery commander, Battery E.
Battery commander, Battery F.
Etc.
- (6) Fort commander, Fort B.
Fire commander, first fire command, Fort B.
Battery commander, Battery A.
Battery commander, Battery B.
Etc.

The duration of each move is one minute, and when the umpire decides that that period has elapsed, he should give the signal for the termination of the move. This may be done by ringing a bell or by knocking on the table.

It is possible that during some move no commander will desire to give any orders. If this be the case the coast-defense commander inquires of each fort in turn, as, "Andrews, any orders?" In case there be none, the fort commander raps three times on his desk. Similarly for each of the other forts in turn, and the umpire gives the signal for the next move. As soon as the curtain is drawn the officer in charge of

each division causes his ships to be moved the proper distance, using the speed scale for that purpose.

Rate of fire.—The rate of sustained fire for the different types of armament in the fixed defenses are assumed to be as follows:

Mortars, one salvo per pit every two minutes.

Primary, one round per gun per minute.

Intermediate, four rounds per gun per minute.

Secondary, eight rounds per gun per minute.

To allow for the time required for indicating and identifying the target, making first observations, checking the plotting, and adjusting the data, batteries are permitted to open fire as follows:

Mortars open fire at full rate during the fourth move after assignment to a target.

Guns of the primary armament open fire at full rate during the third move after assignment to a target. If emergency system is to be used, fire is opened during the second move.

Guns of the intermediate and secondary armaments open fire at half rate during the second move after assignment to a target. Thereafter they fire at full rate.

Changing targets.—When the fire of a primary gun or mortar battery is changed from one ship to another in the same division, hits may not be scored until the second move after the command to change target. If the new target is in a different division full time must elapse as in an original assignment of targets. If any change of targets, intermediate and secondary batteries open fire as in an original assignment.

When a battery is firing, no time need be lost in changing from one system of range finding to another.

Scoring gunfire.—Hits are scored by drawing cubes from the proper hit bag. For mortars a single cube is drawn, each move for each pit salvo; for all guns a single cube is drawn, each move for each gun. The numbers marked on the cubes indicate thousands of yards of range. To score a hit it is necessary to draw a number equal to or greater than the range to the target as posted on the range board. After examining the cube it should be returned to the bag before drawing for the next gun.

After the elapse of the proper number of moves after receipt of assignment the battery commander draws cubes from his hit bag as indicated in the preceding paragraph. The procedure of scoring the effect of gun fire is as follows:

Mortar battery.—Glancing at range board, the battery commander sees from column 6 that the range to his target (*Kongo*) is 10,000 yards. He draws from his hit bag one cube for each pit salvo. If he draws a cube No. 10, 11, 12, 13, 14, or 15 (i. e., 10 or greater), it scores as a hit. He then glances at the localizer and sees that his pointer (12 o'clock) points to No. 7. Turning to his score card of a type battle cruiser he marks on deck plan (since it is a mortar hit) a pencil circle around hit No. 7 (conning tower) and holds the score card over his shoulder so his fire commander can see and note the hit made.

Gun battery.—Glancing at the range board, the battery commander sees from column 6 that the range to his target (*Arkansas*) is 9,000 yards. He has fired two shots, hence he draws one cube from his hit bag, notes its number, returns the cube to the bag, and draws another cube, notes its number and returns it to the bag (two cubes drawn in succession). If the number on either cube be a 9, 10, 11, 12, 13, 14, or 15 (i. e., 9 or greater) it scores a hit. He then glances at the localizer and sees that his pointers (3 and 6 o'clock, since he has two guns) point to No. 5 and No. 12. Turning to his score card of a type dreadnaught, he marks on broadside section (since it is a gun hit) pencil circles around hits No. 5 and No. 12. No. 5 is a hit in the turret base (aaa—10-inch—12-inch) and by consulting his penetration curve he sees that at 9,000 yards a 12-inch gun can just get through that amount of armor. No. 12 is a hit on the broadside belt (aaaa—12 and greater), and since a 12-inch gun at 9,000 yards can penetrate

less than 12 inches, his hit is not effective. He holds his score card over his shoulder so his fire commander can note the result of the hits he has made.

The fire commander by noting on his score card the hits obtained by his batteries is able to form an opinion as to when sufficient damage is done to justify him shifting the fire of his batteries to other targets.

From time to time as hits are made on ships the umpire awards penalties. The first penalty for capital ships is usually a reduction in speed by one-fourth, then by one-half, then by three-fourths.

The following table, adopted from that used in the Naval War Game, will assist the umpire in awarding damages:

Destruction table.

	Number of hits required for destruction of—														
	Superdreadnaught.					Dreadnaught.					Battle cruiser.				
Caliber of gun.....	14"	12"	10"	6"	3"	14"	12"	10"	6"	3"	14"	12"	10"	6"	3"
Range:															
2,000-4,000.....	15	18	21	.....	.....	10	13	16	.....	.....	7	9	11	.....	.....
4,000-6,000.....	17	20	23	.....	.....	12	15	18	.....	.....	8	10	13	.....	.....
6,000-8,000.....	19	22	25	.....	.....	14	17	15	.....	.....	9	11	15	.....	.....
8,000-10,000.....	21	24	27	.....	.....	16	19	22	.....	.....	10	12	17	.....	.....
10,000-12,000.....	23	26	29	.....	.....	18	21	24	.....	.....	12	14	19	.....	.....
12,000-14,000.....	25	28	31	.....	.....	20	23	26	.....	.....	14	16	21	.....	.....
	Monitor-armored cruiser.					Cruiser first class.					Cruiser-scout destroyer.				
	14"	12"	10"	6"	3"	14"	12"	10"	6"	3"	14"	12"	10"	6"	3"
Range:															
2,000-4,000.....	4	5	7	60	.....	2	3	4	30	.....	1	1	1	6	18
4,000-6,000.....	5	6	8	70	.....	2	3	5	35	.....	1	1	1	6	18
6,000-8,000.....	5	7	9	90	.....	2	3	5	45	.....	1	1	2	6	.....
8,000-10,000.....	6	8	10	.....	.....	2	3	5	50	.....	1	2	2	6	.....
10,000-12,000.....	7	9	11	.....	.....	3	4	6	.....	.....	1	2	2	.....	.....
12,000-14,000.....	8	10	12	.....	.....	3	4	6	.....	.....	1	2	2	.....	.....

Scoring ship fire.—Hit bags for scoring ship's fire are described on page 18.

For purpose of assigning land targets the shore line, as viewed from the sea, should be divided into well-defined areas. These areas should be such as to be readily recognized and defined from the ships. At Fort Monroe, for example, these areas are as follows:

1. Fort Wood.
2. The stretch of beach from the engineer dock to north end of the old fort.
3. The low land between the old fort and the south end of the woods near Battery Church.
4. The south end of the woods near Battery Church, etc.

To allow for transmission of orders, identification of targets, ranging shots, etc., ships can open fire two moves after the assignment of a target. The officer in charge of the fleet (or of each subdivision thereof) designates the area selected as a target, and notifies the umpire. One cube is drawn each move for each ship firing. When a hit is drawn, that element whose symbol stops at the pointer (assigned by the umpire to the ship) is credited with being hit. If there be more than one of these elements in the area under fire, the umpire arbitrarily decides which one is hit. If there be no such element in the area a miss is scored. For example, if the pointer for ship No. 2, dreadnaught division, stops at B', the umpire would decide which B' in the area was struck. The ships in a division are assigned to different pointers of the localizer, so that hits scored by two or more ships in the same move will not be on the same element.

During a night phase only areas containing searchlights in action or those illuminated by searchlights can be fired upon.

Ships that are firing indicate this fact to the shore defenses by having a small ($\frac{1}{4}$ -inch) whisp of white cotton placed on the forward gun.

Mine fields.—The umpire causes the mine commander to draw on a chart (1 inch equals 100 yards) the assumed location of each mine field, showing the assumed position of each cable, distribution box, and each mine case. If during any phase, it appears that a vessel is to pass over a mined area, the umpire, by consulting this chart and the course of the ship on the war game board, decides whether the ship will hit the mine or miss it. He also considers such orders as the mine commander may have previously given. If a ship hits a mine set for contact firing, it is considered to have an even chance of sinking. If it does not sink, its mobility and gun fire are reduced 50 per cent.

Land defense.—The war-game board is very useful for solving problems involving the use of the Coast Artillery supports, and for instructing officers and noncommissioned officers in problems in minor tactics. These exercises employ the usual *kreigspiel* methods, and may be conducted by the umpire so as to be simultaneous with an attack from the sea front by warships.

GENERAL INFORMATION.

Sustained speed of vessels other than torpedo craft.—A vessel may maintain maximum speed for 12 hours.

A vessel may maintain 2 knots less than maximum speed until coal is exhausted or until the umpire declares a breakdown.

Maximum formation speed is 2 knots less than maximum speed of slowest vessel.

The above rules are for fair weather and clean bottoms. The umpire will decide on reductions of speed to fit other conditions.

Sustained speed of destroyers.—A destroyer may maintain maximum speed for four hours; it must then slow to 5 knots less than maximum speed for six hours.

A destroyer may maintain 5 knots less than maximum speed until coal is exhausted or until the umpire declares a breakdown.

Maximum formation speed for destroyers is 2 knots less than maximum speed of slowest vessel.

Sustained speed of torpedo boats.—A torpedo boat may maintain maximum speed for two hours; it must then slow to 5 knots less than maximum speed for three hours.

A torpedo boat may maintain 5 knots less than maximum speed until coal is exhausted or until the umpire declares a breakdown.

Estimates for fuel supply to fleet.

Knots per hour.....	10	12	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Class.	Daily coal expenditure in per cent of bunker capacity.																		
Dreadnaught...AA	3	3	5	5	6	7	8	10	12	15	...	...	...	...	...	...	...	...	...
Battleship, first class.....A	4	4	6	7	8	10	13	...	...	...	...	...	...	...	...	...	...	...	...
Battleship, second class.....N	5	7	11	13	15	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Battle cruiser ¹ BB	3	4	6	7	8	9	10	11	12	13	14	16	17	18	19	...	...	...	...
Armored cruiser.B	4	6	8	10	11	13	15	18	23	30	31	...	...	...	...	...	...	...	...
Monitor.....M	10	13	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cruiser, first class.C	5	6	8	10	12	14	17	22	30	...	...	...	...	...	...	...	...	...	...
Cruiser, second class.....F	5	7	10	12	13	15	17	19	21	...	...	...	...	...	...	...	...	...	...
Scout, naval.....S	5	7	9	10	11	12	14	15	18	20	23	27	31	...	...	...	...	...	...
Destroyer ² VV	10	11	12	14	24	16	18	20	22	25	29	33	37	42	47	53	60	68	76
Destroyer ³ V	11	13	17	20	23	27	31	37	43	51	60	69	80	93	108	126	148	...	...
Torpedo boat.....T	10	15	22	27	32	39	48	58	70	82	94	107	126	135	151	167	183	201	...
Scout, merchant.E	3	3	3	3	4	5	6	7	9	...	...	...	...	...	...	...	...	...	...

¹ Estimated.

² Over 700 tons.

³ Less than 700 tons.

The rate of consumption of coal by the fleet and train for 10 knots speed based upon average conditions of hull and machinery and average steaming efficiency:

Battleships.....	} Four-ninths of a ton per mile per ship.
Armored cruisers....	
Cruisers, first class...	
Naval scouts.....	
Cruisers, second class	} One-sixth of a ton per mile per ship.
Gunboats.....	
Merchant scouts.....	
Auxiliaries.....	
Transports.....	} One-tenth of a ton per mile per ship.
Destroyers.....	

The daily fuel consumption in port is equivalent to the amount consumed in steaming 70 miles at sea at 10 knots speed.

One ton of fuel is equivalent to 1.4 tons of coal.

Naval mine layers.—A ship struck by a mine will be given an even chance to sink or float. If afloat, she will be considered as having lost one-half of her floatability. Her remaining effective gunfire will be reduced one-half.

Mine layers will be assumed to carry 300 mines, 150 on deck and 150 in the hold, but to have capacity for carrying all on deck and to be able to lay them at a rate of one every five seconds. The spacing of mines will ordinarily be assumed to be 50 yards, unless elected to the contrary, and the danger space of the mine 10 feet. The depth of the water may not exceed 200 feet for controlled mines and 100 feet for contact mines. The strength of the current shall not exceed 2 knots when the mine may be laid, except in the case of ground or dormant mines. The depth of water for ground or dormant mines shall not exceed 35 feet.

The speed of the mine layer may not exceed 19 knots, and her life shall be the life of that type of ship used for the purpose, less 10 per cent penalty imposed on that life on account of duty upon which she is employed.

Torpedo craft.—Torpedo craft may be used as mine-laying vessels as follows:

(1) The time for laying each mine shall be 10 seconds and the number of mines carried 12.

(2) Floating mines may be towed by torpedo craft, but the number towed shall not exceed three, and the speed of the towing vessel shall not exceed 12 knots.

(3) Dummy mines and objects to resemble the periscope of a submarine may be towed, floated, or planted.

Submarines.—Mines may be towed by submarines awash and in submerged condition with periscope up, but the number shall not exceed three. Dummy mines may be towed, floated, or planted.

Other vessels.—Scouts, cruisers, mine layers, converted merchant ships, and destroyers may perform the same function as mine layers, as regards mines, dummy mines, etc., and the conditions will be the same as laid down for torpedo craft. The speed shall not exceed 12 knots when towing floating mines.

Dragging.—The time for clearing a mine field by dragging shall be the time taken for a ship fitted for dragging to cover that particular portion designed to be cleared, at a speed of 6 knots. When a field has been supposed to be cleared of mines by dragging, it will be assumed as an even chance that one-sixth of the mines have not been entirely cleared away. Submarines in addition to their regular use may be allowed to work subsurface in creeping for the cables of controlled mines.

Owing to the dangers involved in creeping and working on a field of mines, the danger of detection and destruction by surface craft while operating in this way below surface, the submarine will be assumed to stand a one-third chance of destruction while engaged in this work.

Fish nets and booms may be used to protect a mine field, and the chances will be assumed as even as to whether they protect or not.

Submarines.—A submarine may go from the light to the awash condition in three minutes. From the awash to submerged condition in three minutes. The same time will be used in reversing the process.

Each boat carries four submerged tubes. Eight torpedoes are carried. The torpedoes have a range of 4,000 yards at 30 knots.

Each submarine is fitted with a radio set that can be used only when in the light condition. Maximum radio range, 50 miles.

Fifteen minutes are required to dismantle the radio set, previous to submerging, and 30 minutes to get it up after resuming the light condition.

All boats are fitted with the submarine bell and receiver. The maximum range for signaling by this method will be considered as 1 mile.

When making an attack at night, except at stationary targets, submarines will be treated as surface boats.

Limit of vision through conning tower lenses, 1 mile.

The submerged radius of action will be considered as follows:

11 miles at 11 knots speed.	13 miles at 10 knots speed.
18 miles at 9 knots speed.	32 miles at 8 knots speed.
75 miles at 5 knots speed.	

Miscellaneous.—Limit of vision from a ship, 15 miles; from an aeroplane, 30 to 40 miles in clear weather.

Aeroplanes.—Extreme limit of duration in air for an aeroplane will be four hours. No aeroplane may make more than two flights of two hours each per day, or one flight of four hours and one of two. In each case two hours must elapse between flights. The speed allowed will be 60 miles per hour.

Radio limits—

	Day.	Night.
Battleships.....miles..	400	1,000
Destroyers.....do....	75	150
Colliers and auxiliaries.....*	150	300
Shore stations.....do....	500	1,200
Submarines.....do....	25	25
Aeroplanes.....do....	20	20

Distance to horizon at sea.

Height of eye.	Distance.		Height of eye.	Distance.	
	Yards.	Miles.		Yards.	Miles.
5 feet.....	4,820	2.7	90 feet.....		11.6
10 feet.....	6,800	3.9	100 feet.....		12.2
20 feet.....	9,620	5.5	200 feet.....		17.3
30 feet.....	11,800	6.7	300 feet.....		21.2
40 feet.....	13,360	7.8	400 feet.....		24.5
50 feet.....	15,240	8.7	500 feet.....		27.4
60 feet.....		9.5	600 feet.....		30.0
70 feet.....		10.2	800 feet.....		34.7
80 feet.....		10.9	1,000 feet.....		38.7

Velocity of sound.

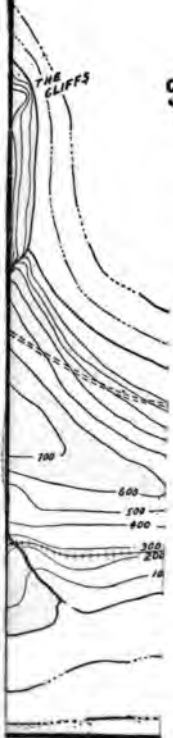
	Miles.		Miles.
1 second.....	.21	11 seconds.....	2.31
2 seconds.....	.42	12 seconds.....	2.52
3 seconds.....	.63	13 seconds.....	2.73
4 seconds.....	.84	14 seconds.....	2.94
5 seconds.....	1.05	15 seconds.....	3.15
6 seconds.....	1.26	16 seconds.....	3.36
7 seconds.....	1.47	17 seconds.....	3.57
8 seconds.....	1.68	18 seconds.....	3.78
9 seconds.....	1.89	19 seconds.....	3.99
10 seconds.....	2.10	20 seconds.....	4.20

The above estimates of the velocity of sound are for calm weather and the usual summer temperature. Extreme heat and extreme cold affect the velocity of sound in that they will make it travel faster or slower, respectively.

BOCA GRANDE



THE CLIFFS



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CHAPTER IV.

THE FALL OF DURAZZO.

A maritime nation after mature investigation selects certain points of its coast line as being essential to its continued existence as a sovereign State. The places selected are usually those of great commercial or military importance and vast sums of money are expended in providing what is considered by competent military authorities an adequate defense both on the land and sea front. Fortifications are constructed, guns mounted, submarine mines planted, and all of the adjuncts of the defense are carefully planned and installed. A large portion of the available armed forces of the nation is employed to keep these defenses in a proper state of efficiency, to be ready for action at or before the outbreak of war.

History furnishes many examples where fleets have found it essential to the successful prosecution of war to attack fortifications. The recent wars have furnished numerous examples, among which the attack on Tsin Tao, the Dardanelles, and Port Arthur are conspicuous examples.

Combinations of guns and mines do not per se make an efficient defense, a result only to be attained by assiduous training on the part of those in command. In 1903 and 1905, and again in 1913, upon the instigation of the Chief of Artillery, and with the cooperation of the Navy, much was accomplished in the training of the Coast Artillery to perform efficiently its war-time functions in repelling various forms of naval attack. The proper handling of the elements of a coast-defense command can not fail to be a most complicated problem, involving not only rare coolness and unerring judgment on the part of the various commanders but frequent rehearsals of the constituent phases of the general attack.

In many ways the seaward defense of a coast-defense command is unique when considered in the light of battle. It is the only occasion in war-like operations where the mise en scene is definitely fixed before the first hostile shot is fired; the only occasion where the avenues of approach are rigidly fixed; where the strength and resources of one side can not be reinforced during the progress of the engagement; and where the various phases of possible attack and defense can be fully planned and minutely rehearsed. Failing in such training, the inherent power of the shore defenses must unavoidably be lost in the resulting confusion of the relatively short action.

With a view to investigating the various stages of an attack from its inception until finally carried to its ultimate conclusion, to stimulate and encourage thought and investigation along the lines of the best means of defense, and to assist those charged with the preparation of similar problems to be used in the Coast Artillery war instruction, the following problem has been drawn.

PROBLEM.

A state of war exists between Blue and Black, the latter having command of the sea. Admiral Brin, with a Black fleet is approaching Durazzo, with orders to occupy the same. Durazzo, 4,000 miles from Admiral Brin's base, is that port whose occupation by Black within 30 days is essential to the successful prosecution of the war. It is situated on an island, as shown on the accompanying chart, and located near Roncador Cay, 350 miles due north of the Atlantic entrance to the Panama Canal.

Durazzo is a city of size, importance, and resource (naval and military) similar to Norfolk, and is capable of drawing its food for three months from the supply on hand.

It contains a naval dockyard of the first class. The fortifications, so far as Admiral Brin's information goes, are shown on the accompanying chart. They are manned

by the regular garrison, presumably of normal strength, supported by the local militia organizations. No reliable information is available as to their efficiency nor as to the amount of ammunition available.

The approaching Black fleet is composed of—

5 AA.	4 A.
4 BB.	4 B.
3 C.	21 VV.
10 SM.	10 colliers.
2 repair ships.	1 mine layer.
2 hospital ships.	3 supply ships.

Required.—Admiral Brin's general estimate of the situation to be arranged under the following headings:

(a) Mission; (b) Enemy's forces, strength, and disposition; (c) Terrain; (d) Probable intentions; (e) Black forces, and organization; (f) Wind, weather, and tide; (g) Decision.

SOLUTION.

(a) *Mission.*—Admiral Brin's mission is to occupy this port within 30 days. Hence no amount of destruction by bombardment alone can fairly be assumed to accomplish his mission, so long as sufficient armament is left intact to deter the Black fleet from entering the port. A single battery of mortars or howitzers remaining unsilenced will be sufficient to prevent the accomplishment of his mission. The military importance of Durazzo is such as to warrant the greatest vigilance on the part of its defenders, and Black can scarcely hope to take the defenses by surprise.

(b) *Enemy's forces, strength, and disposition.*—Admiral Brin's information as to the defense is limited to such as has been collected in time of peace by the Black general staff, and naturally is deficient in many respects, hence his initial movements must be characterized by caution. He must endeavor by every possible means to amplify his knowledge. He knows that Florida, Binanga, and Stingaree Points are fortified, as well as the islands at the entrance to the harbor. The accompanying chart shows the probable location and caliber of the armament, the position of the searchlights, and the cable landing. From the conformation of the harbor, the mining casemate is probably on Fort Cotton. He has no definite information as to whether or not Durazzo shelters any hostile warships, but being a naval port of the first class, the presumption is that it does. As the appearance of hostile ships would seriously interfere with his plans, he must take the necessary precautions to make himself secure from such attempts. In the absence of specific information to the contrary, he is warranted in assuming that no large body of mobile troops is to be encountered.

(c) *Terrain.*—The chart shows Durazzo Island to be surrounded by coral reefs and that there are but few, if any, available landing places for troops. The two entrances to the inner harbor are broad and deep, and will be easily navigable at night. Mine fields may be expected in Boca Chica, but Boca Grande will be difficult to mine. It is doubtful whether there are positions from which the inner harbor may be bombarded, but a position to west of Mount Wachusett is promising.

The location and establishment of a suitable advanced base in the near vicinity of Durazzo is indispensable for the successful prosecution and development of the attack. Charity Bay, 20 miles northeast of the entrance to Durazzo, offers the most suitable harbor for this purpose.

(d) *Probable intentions.*—Since Blue can not expect relief within 30 days he must husband his ammunition and supplies and only open fire when adequate damage to hostile ships is probable. He will refrain from needlessly revealing the exact positions of his batteries, or of putting into action searchlights whose position is not known to the defense. He will endeavor to provide additional concealment for his outlying range stations. To avoid disclosing their exact position he will endeavor to repair and maintain his mine fields only after dark.

(e) *Black forces.*—Strength and disposition. Blacks' forces being as stated above, will be organized as follows:

BLACK FLEET, Admiral BRIN, commanding.
Independent flagship, California.
Dispatch boat, destroyer Flusser.

FIRST SQUADRON.

<i>First division.</i>		<i>Second division.</i>	
Admiral A, commanding.		Admiral B, commanding.	
New York (flag).	Texas.	Wyoming (flag).	Arkansas.
Nevada.	Oklahoma.	Utah.	Florida.

SECOND SQUADRON.

<i>Third division.</i>		<i>Fourth division.</i>	
Admiral C, commanding.		Admiral D, commanding.	
Lion (flag).	Goeben.	Scharnhorst (flag).	Gneissnau.
Princess Royal.	Queen Mary.	Prince Henry.	Blucher.

DESTROYER FLOTILLA.

Birmingham (flag), Admiral S, commanding.

<i>First division.</i>		<i>Second division.</i>	
Cassin, 1,020 tons (flag boat).		Aylwin, 1,036 tons (flag boat).	
Cummings, 1,020 tons.		Balch, 1,036 tons.	
Duncan, 1,014 tons.		Benham, 1,036 tons.	
Downes, 1,072 tons.		Parker, 1,036 tons.	
<i>Third division.</i>		<i>Fourth division.</i>	
McDougal, 1,052 tons (flag boat).		Drayton, 742 tons (flag boat).	
Nicholson, 1,052 tons.		Jouett, 742 tons.	
O'Brien, 1,052 tons.		Jenkins, 742 tons.	
Winslow, 1,052 tons.		Paulding, 742 tons.	

SUBMARINE FLOTILLA.

Columbia (flag), Admiral G, commanding.

<i>First division.</i>		<i>Second division.</i>	
N-1 (flag boat).	N-3.	O-1 (flag boat).	O-2.
N-2.	N-4.	O-3.	O-4.
	N-5.		O-5.
<i>Third division.</i>		<i>Fourth division.</i>	
O-6 (flag boat).	O-7.	L-1 (flag boat).	L-2.
O-8.	O-9.	L-3.	L-4.
	O-10.		L-5.

TRAIN.

Olympia (flag), Admiral H, commanding.

Panther, repair ship.	Vestal, repair ship.
San Francisco, mine layer.	Relief, hospital ship.
Solace, hospital ship.	Celtic, supply ship.
Glacier, supply ship.	Culgoa, supply ship.

Jason (10,500 tons coal, 2,586 tons oil).
Orion (10,500 tons coal, 2,586 tons oil).
Nireus (10,500 tons coal, 3,081 tons oil).
Proteus (10,500 tons coal, 3,081 tons oil).
Neptune (10,500 tons coal, 2,929 tons oil).
Cyclops (10,457 tons coal, 2,923 tons oil).
Jupiter (10,457 tons coal, 2,923 tons oil).
Hector (8,128 tons coal).
Mars (8,128 tons coal).
Vulcan (8,128 tons coal).

(f) *Wind, weather, and tide.*—During the next 30 days the northwest trade winds will be blowing, and fair fixed weather may be counted upon. The tides at Durazzo are less than 3 feet maximum and facilitate the planting of submarine mines by the defense. Fogs or hazy weather are rare, and searchlights of the defense may be relied upon to give maximum range.

(g) *Decision.*—The efficiency of the shore defenses during a night engagement is limited by the number, power, and efficiency of its searchlights. Generally speaking, since only illuminated targets can be attacked, the gun power of the defense is limited by the number of available lights, hence it will be of great importance to develop by reconnaissance, the location, range, and power of all searchlights. While the attacking fleet finds difficulty in navigating strange and often narrow channels, the difficulties of a night attack are more than compensated for by the reduction in the efficiency of gun fire due to the guns depending upon the searchlights.

An examination of the accompanying chart shows that Durazzo Island is surrounded by coral reefs, and that it offers but few landing places suitable for large bodies of troops. Appreciating this condition, and realizing that the Black Fleet is not accompanied by any mobile Army troops, and that any large landing parties drawn from the fleet for the purpose of attacking the defenses from the land side would seriously handicap the fighting efficiency of his fleet, Admiral Brin will not attempt to land any large body of men. His general plan of attack will be as follows:

(a) General reconnaissance by day with a view to locating general approaches to harbor, determining what aids to navigation have been removed, etc., locating the exact position of such batteries, and their arc of fire, locating such range and signal stations as may be visible, grappling and cutting the submarine cable. Reconnoitering and occupying a suitable advanced base in Charity Bay. Establishment of a blockade at entrance to Durazzo Harbor just beyond effective range of shore guns.

(b) Night reconnaissance by fast units in scattered formation with a view to locating searchlights.

(c) Repeated and persistent raids to destroy searchlights.

(d) Night reconnaissance of mine fields.

(e) Day and night bombardments of batteries, from long range positions, if possible beyond range of shore guns.

(f) Night raid on mine fields, supported by a night bombardment.

(g) Runby into inner harbor.

BLACK'S LINE OF ACTION.

Base.—Selection of Charity Bay as an advanced base, detachment of first Destroyer Division to reconnoiter and hold same. This will involve landing on each island several small officers' patrols. An elaborate and careful search must be made by day and night for submarine mines, signal stations, cables, or any means of defense or offense. Commander C. is detailed as base commander.

Fleet orders announce the location of the following rendezvous:

Rendezvous A, 20,000 yards due north of Fort Cotton.

Rendezvous B, 10,000 yards northeast of Fort Cotton.

The station of the independent flagship will be at rendezvous A, to which place all information will be sent.

Blockade.—To prevent ingress or egress of hostile vessels, the main entrance will be immediately blockaded, a blockade proclamation issued, and the Second Division will be detailed to establish the blockade.

The blockading division will be relieved daily. It will endeavor by constant movement and sallies to retain the artillery garrison at its fighting stations, allowing them as little uninterrupted rest as is possible.

Reconnaissance, day.—Reconnaissance for—

(1) Landing places not in field of fire, for location and destruction of commercial cables (if possible, the latter should be effected at the earliest possible moment). Detail of Second Destroyer Division for this purpose.

(2) Discovery of naval vessels in harbor. Detail from first submarine division to enter Boca Grande and endeavor to penetrate the naval port, reporting any information to rendezvous A.

(3) Location of military resources of port by landing of officers' patrols. Four officers' patrols to be landed in small boats from first Division. Information to be reported to rendezvous A.

The foregoing disposition is to be commenced during the first night.

Upon receipt of reports of the reconnaissance, the following additional moves will be made:

Reconnaissance for the purpose of—

(a) Verifying location and areas of fire of known batteries, and for developing the position of any heretofore unknown.

(b) Location of position finding stations, radio or other signal stations.

(c) Selection of aiming points.

(d) Location and placing of buoys for the estimation of ranges, and for marking safe avenues of approach.

To accomplish these ends, it is essential that the Black fleet engaged be of sufficient strength and that it approach in such a manner as to cause the defenders to open fire. For this purpose the first, third, and fourth divisions will be detailed to make the demonstrations against the fortifications. While endeavoring to draw the fire of the shore defenses, the divisions will approach no nearer to the defenses than is necessary, and ammunition will be expended only for useful purposes. During the approach of the Battle fleet, the first and second submarine divisions will reconnoiter Boca Grande and Boca Chica, respectively, for the purpose of determining the location of the mine fields and the position of the mine defense guns.

Upon the completion of these maneuvers each division commander will report his conclusions and observations to the chief of staff at rendezvous A.

As a result of this reconnaissance the shore defenses will be subdivided into areas, whose limits can be readily recognized from the sea. The sections will be numbered consecutively from right to left. They will be referred to by number when assigned to individual ships as targets.

Reconnaissance, night.—Upon the first favorable night, a reconnaissance for the location of the searchlights will be conducted. Each division will detail one ship's steamer, provided with two hooded lights in vertical line, to locate shoals and turning points. These mark boats will report to Commander K. and be anchored by 1.30 a. m., in positions to be selected by him.

The first, third, fourth, and fifth divisions will report at rendezvous B. at 2 a. m. An endeavor will be made to impress the enemy with the danger of an impending passage of the entrance, thereby drawing into action all searchlights.

Raids.—Attacks on the searchlights will be continued nightly until, by their destruction, the efficiency of the defenses has been materially reduced, and repeated raids will be made to clear Boca Grande and Boca Chica of mines by dragging and sweeping the channels, using available destroyers and submarines. In case any mines are destroyed, if the defense attempts to replace or repair the mine fields, the commander of the blockading division will open fire on any mine-laying vessel. For this purpose, the blockading division will close in at night so as to be just beyond the range of efficient illumination, probably 8,000 to 9,000 yards, retiring at daylight so as to be just beyond effective range of the guns of the defense.

Each division will be assigned to a section and will endeavor to destroy the searchlights therein by rapid fire. This attack on the searchlights will be supported by a raid on the mine fields, to be made by the third and fourth destroyer divisions and the first and second submarine divisions (awash). Each vessel of the raiding division will trail astern a grapnel with 60 fathoms of cable. They will enter Boca Chica and, if possible, return via Boca Grande. Upon the completion of this maneuver the commanders of divisions will report the result of operations to the chief of staff at rendezvous A.

To summarize, Admiral Brin's action will be—

- (a) Selection and reconnoissance of advanced base.
- (b) Establishment of blockade.
- (c) Reconnoissance of island—cable cutting.
- (d) Reconnoissance of naval harbor.
- (e) Day reconnoissance of shore defenses.
- (f) Night reconnoissance of searchlight positions.
- (g) Raid on mine fields.
- (h) Continued attacks on searchlights and mine field raids.
- (i) Runby.

CHAPTER V.

NOTES ON ARMAMENT AND ACCESSORIES.

I. LOCATION OF FORTIFICATIONS.

Since the war-game board is very useful for studying general problems of coast defense as well as for the purpose of locating positions for new batteries, searchlights, etc., the following notes on the location of the armament and its accessories are given.

Considering the continental position of the United States and recognizing the importance of the navy as the first line of defense, fortified ports are divided into two classes:

(a) Those which from a naval point of view are of strategic importance for successful operation of the fleet, are called "ports of the first importance."

(b) All others which the national policy requires to be fortified are called "ports of secondary importance."

General considerations.—There are certain considerations which govern the selection of the site of any coast fortification (i. e., group of batteries). These may be enumerated as follows:

(a) The particular site must be selected with reference to some *raison d'être*. It may be chosen to protect a naval base (Fort Monroe), to deny to the enemy the use of some inland water or sheltered roadstead (Cape Henry), to protect a commercial center (Portland), to cover strategic lines of railways (Narragansett), etc., but in each case its location must be such as to compel the enemy to attack it before gaining possession of the naval base, inland waterways, etc.

(b) The site chosen must be sufficiently advanced to prevent the hostile fleet from effectively bombarding the place protected without being subjected to the fire of the fortifications.

(c) The constituent elements (i. e., the individual batteries) should be mutually supporting, so that they can not be fought and silenced in succession.

(d) The batteries, while concentrated so as to permit of grouping for purposes of fire control, must be sufficiently dispersed to deprive the ships of the advantages of concentration of fire.

(e) A clear field of view of the water area to the front and flanks is essential to all gun batteries, position-finding stations, and searchlights.

(f) In the selection of any particular site, due and careful consideration should be given to landward defense, as an attack from that side is more likely than from the seaward front. For this reason, other considerations being equal, available islands offer many attractions.

(g) The general question of the location of the necessary adjuncts (i. e., mine fields, available base lines, and effective searchlights), should be fully considered before the particular sites for the individual batteries are decided upon. Small islands limit the choice of horizontal base end stations and effective searchlight positions.

(h) Fortifications should be located so as to be most economically supplied and effectively administered. This condition will largely affect the fighting efficiency on account of its direct bearing on drills, tactical exercises, and maneuvers.

Choice of calibers.—The present armament of the coast fortifications of the United States may be classified as—

Fixed, with permanent emplacements.

Mobile, for repelling land attacks.

The fixed armament may be further subdivided as follows:

(1) Major, i. e., guns of 8-inch and larger caliber, including 12-inch mortars.

(2) Intermediate, i. e., 6-inch, 5-inch, and 4.7-inch guns.

(3) Minor, i. e., 4-inch and 3-inch guns.

This multiplicity of calibers, which is objectionable, is the result of a gradual development of the present accepted types of gun and carriage and growth of power of ships' guns.

The last comprehensive report upon the needs of our seacoast defenses was that made by the Taft Board on February 1, 1906. The period that has elapsed since the date of the report of the Taft Board has been marked by radical changes in naval designs, which included the development of the dreadnaught type of battleship, a type carrying heavier armor and much more powerful ordnance than its predecessors. As a consequence both the offensive and defensive capabilities of warships have been materially increased.

In recognition of this development the War Department during the early part of the current year adopted the policy that the major caliber direct-fire gun to be installed in future should be of at least 16-inch caliber. Considerations of the same character, more particularly the greater structural strength and increased deck protection of modern battleships, have led the Board of Review to recommend that seacoast mortars to be installed in future should be of 16-inch caliber. In addition to these types, the projects, as outlined hereinafter, call for the utilization as howitzers of a number of 12-inch guns that are now on hand by mounting them on barbette carriages of a special design that will permit of the attainment of a range of 30,000 yards.

The total additional armament for continental United States included in the above projects comprise twenty-two 16-inch guns, twenty-four 12-inch guns mounted for long-range fire, twenty-three 6-inch and four 3-inch guns, and forty-eight 16-inch mortars; for the insular possessions eight 12-inch guns mounted for long-range fire; and for the Panama Canal four 16-inch guns, four 12-inch guns mounted for long-range fire, and twelve 16-inch mortars.

In addition to the above, the projects of the board include one hundred and thirty-four 3-inch antiaircraft guns for the seacoast defenses of continental United States, seventeen 3-inch antiaircraft guns for the insular possessions, and eight 3-inch antiaircraft guns for the Panama Canal.

The board also recommends the construction of six 16-inch movable howitzers and an experimental 14-inch gun on railroad car mount for defense against hostile landings in unfortified harbors.

The choice of calibers for any particular site depends directly upon the object of the fortification and its character. For the defense of a narrow river, as the Potomac or Delaware, or Cape Fear, a mine field protected by 6-inch rapid-fire guns would probably be adequate.

The increased power and rapidity of fire of the latest models of the 6-inch rapid-fire guns obviates to a great degree the use of the older models of the 8-inch and 10-inch guns. In addition to supplementing at short ranges the primary armament, 6-inch guns are used to protect distant mine fields.

The 3-inch gun is used against torpedo craft, air craft, and light cruisers, and is employed for the protection of the normal mine fields.

The defense of ports of the first importance with entrances of moderate width usually include guns of 12-inch caliber, which are particularly adapted for attacking the heaviest ships, while for the protection of wide channels, such as exist at the

entrance to Long Island, Manila Bay, and Panama, the 14-inch or 16-inch guns are peculiarly suited.

Mortar batteries were originally designed to fire at fixed targets, and were formerly expected only to cover anchorages from which a bombardment might be expected. However, with improvements in the gun, carriage, and methods of fire control, the accuracy of fire from mortar batteries has been greatly increased, and they are now considered as one of the most important elements of the defense. The fact that their fire is particularly effective at long ranges against the weakest part of a ship, i. e., the protective deck, supplements at extreme ranges the diminished penetrative effect of the other guns of the primary armament.

The all-round fire obtainable from this class of battery is particularly valuable in covering the dead sectors of other types of batteries protecting interior waters, and for effective land defense.

The number of guns required.—From time to time many authorities have given rules for determining the number of guns required for the adequate defense of any given port. These rules were generally based upon empirical formulæ, usually that one gun ashore was equal in efficiency to x guns afloat. None of these rules have proved satisfactory, and the dictum now accepted is that an adequate defense is provided "if the armament will compel the enemy to land in order to effect a capture;" that "it has fulfilled its functions, and any increase in armament thereafter is an unwarrantable expense in material and personnel."

Eliminating from consideration those comparatively narrow rivers which may be efficiently defended by mine fields protected by rapid-fire batteries, it is not an easy question to determine with mathematical precision the exact number of guns required for the adequate defense of a given locality, but by assuming the emplacement of a given number of batteries of stated caliber, it is possible by use of the Coast Artillery War Game to determine the number of vessels that may be fairly assumed as rendered hors de combat by them.

II. LOCATION OF BATTERIES OF THE MAJOR ARMAMENT.

Having chosen the general site for the fortifications from a consideration of the principles laid down above, the particular site for an individual gun battery of the primary armament should be selected.

(a) If possible the axis of the principle channel of approach and the normal line of fire should make an angle of not less than 30 degrees at a range of 6,000 yards.

(b) Moderate height of site is desirable, facilitating observation of fire, position finding, and concealment. Spotting surfaces in front and shell catchers immediately in rear should be avoided.

(c) Concealment; to lessen liability to injury, to increase difficulty of silencing the guns and to increase the efficiency of fire through calmness given to gunners.

(d) Fire commands or four batteries each should contain guns of the same offensive value, i. e., guns of the same caliber. Guns and mortars should not be in the same fire command.

(e) Avoid unnecessary stretches of sandy beach in front of a battery, as the heat waves arising therefrom on a bright sunny day may seriously effect the accuracy of fire.

(f) Each battery of primary guns should have a clear field of at least 15,000 yards, or a portion of its inherent power will be lost.

Mortar batteries should—

(g) Cover main channel of approach with minimum number of effective zones.

(h) Be concealed from view if possible.

(i) Be available for all-round fire to cover inland waters and be capable of use for defense of land fronts.

(j) Be retired from the shore line so as to have as little as possible of minimum ineffective zone over important water areas.

III. LOCATION OF GUNS OF THE INTERMEDIATE ARMAMENT.

In selecting sites for guns of the intermediate armament, it must be borne in mind that their object is to attack unarmored vessels, to support the primary armament in the attack of armored vessels and to protect mine fields at long range. The most important of these is the protection of distant mine fields, as our system of defense is built upon the hypothesis that modern battleships with high speed and heavy armor can, under certain circumstances, successfully run by shore batteries if the channel is not effectively closed by mine fields. Hence the defense of the mine fields is of first importance. As the conditions governing the selection of sites for the guns of the intermediate armament are not of such number nor so severe as those controlling the location of the primary armament, the latter should have the first place. The following conditions should, however, be fulfilled:

- (a) To bring an effective rapid fire on the distant mine fields (4,000 yards).
- (b) Not to obstruct the field of fire of the primary armament.
- (c) To be concealed.
- (d) To have sufficient height for observation of fire.
- (e) To be grouped in fire commands.

IV. RESERVE AMMUNITION.

The present basis for reserve seacoast ammunition supply is as follows:

- (a) For guns in continental United States, except guns of 8-inch caliber and upward on inner lines of defense, allowances equal to one-half the accuracy life of the respective calibers; for mortars, except on inner lines of defense, an allowance equal to one-fourth the accuracy life.
- (b) For armament of 8-inch caliber and upward on inner lines of defense in continental United States, allowances equal to one-half those for outer lines.
- (c) For guns in the insular possessions and on the Canal Zone, allowances equal to the accuracy life of the respective calibers; for mortars, an allowance equal to two-thirds of the accuracy life.

The probable accuracy life, as a function of muzzle velocity and caliber given by Maj. Edward P. O. Hern, Ordnance Department (see *Artillery Journal* No. 132, March-April, 1915), is as follows:

- 6-inch, M. V., 2,600 f. s., 600 rounds.
- 8-inch, M. V., 2,200 f. s., 410 rounds.
- 10-inch, M. V., 2,250 f. s., 350 rounds.
- 12-inch, M. V., 2,250 f. s., 300 rounds.
- 14-inch, M. V., 2,250 f. s., 250 rounds.

V. TACTICAL USE OF SEARCHLIGHTS.

Searchlights are one of the most important elements of the defense in a coast-defense command. Upon their efficiency and correct tactical use will depend largely the successful defense against any naval attack at night.

The standard service searchlights are 60-inch, but there are some 24-inch, 30-inch, and 36-inch searchlights still in service.

Depending upon their tactical use, searchlights are classified as searching or as illuminating lights, and, depending upon their assignment (temporary or permanent), searchlights are classified as fort, fire, or mine searchlights.

The officer controlling the seaward defense of any water area (par. 280, D. R. C. A.) will also control all searchlights covering that area, and will order the various searchlights in action and out of action. He may at any time turn over the control of any searchlight to a junior commander.

For the purpose of controlling the searchlights by command, the searchlight area will be divided into subareas, each designated by a suitable name, which, if prac-

licable, will be the same as the subareas into which the battle area is divided by the coast-defense commander. (Par. 302, D. R. C. A.)

The fort commander's searchlights may be used by the senior fort commander to search various subareas of the battle area in accordance with the special conditions prevailing at the time.

The senior fort commander may assign fire or mine searchlights to search specified subareas, or he may assign certain subareas to be watched by various commanders who, with or without the aid of an assigned searchlight, may discover hostile vessels.

Illuminating lights are intended primarily to illuminate targets assigned to fire or mine commands, and when used for this purpose may be controlled by the fire or mine commanders.

An illuminating light may be used for searching in two ways: First, the fire commander may be directed to search a designated subarea, in which case the searching is done under his orders; second, the fort commander through the matériel officer may direct the searching by telephone, in which case the operator acts under the orders of the matériel officer of the fort command.

A mine light is ordinarily under the control of the mine commander and is used by him for searching the mine field and illuminating targets therein, but may be used by the senior fort commander for other purposes.

When a vessel is discovered by a searching light and the senior fort commander decides to open fire with a fire command, he directs that the vessel be covered by another searchlight, which then becomes the illuminating light for that fire command. When covered by the illuminating light, the searching light may uncover and remain at the disposition of the officer controlling the seaward defense.

The watchers should be men of intelligence, with normal vision (20/20) without the use of corrective lenses, free from color blindness. They will be instructed in the hydrography of the harbor, methods of identification, and characteristics of the various classes of naval vessels and of local shipping. They will be equipped with a pair of field glasses and a head set bridged on the searchlight line and stationed on the outside of their searchlights at such a distance (about 100 yards) as to detect readily any vessel passing into the beam. Any vessel (or target) detected will be reported by telephone to the fort (fire or mine) commander's station.

A searchlight operator should be a man of intelligence, interested in his work, and appreciating its importance, preferably one who has had experience in the use of electrical and mechanical apparatus. Unless necessary, operators will not be changed from searchlight to searchlight, as no two searchlights require precisely the same handling or adjustment.

CHAPTER VI.

TYPE FORMS OF NAVAL ATTACK AGAINST A COAST-DEFENSE COMMAND.

Before he can rapidly and successfully estimate the situation it is essential that the artillery commander should thoroughly understand the type forms of naval attack that may be employed by a fleet when undertaking a campaign against a coast-defense command, and he should be able to quickly recognize them, as well as the mission of the enemy.

The types of naval attack should be frequently rehearsed, until all of the commanders are thoroughly conversant with them.

For this instruction, a variation of the following type forms should be prepared and the ship models put on the board; the instructor should also have a memorandum succinctly stating the mission of the attack, the speed of the various units, whether any of them are firing, and if so at what target, the state of the wind, weather, and tide. When all preliminaries are arranged, the curtain should be drawn and the officers given from three to five minutes to study the situation and form an opinion as to type of attack and the mission of the enemy.

Naval attacks on coast fortifications may be classified as follows:

- Reconnoissances.
- Raids.
- Blocking the entrance.
- Blockades.
- Bombardments.
- Run-bys.

Reconnoissance.—The coast artillerist is apt to assume that his naval opponent has as intimate a knowledge of the strength and location of the batteries and their adjuncts as the coast-defense commander has himself. Such assumption, it is needless to say, is entirely unwarranted. While the naval commander will undoubtedly have certain information relating to the armament of the place to be attacked, such information must of necessity be far from complete. Eliminating from consideration for the present all the attacks in the nature of a surprise, similar to the destroyer raid on Port Arthur on February 8, 1905, any serious campaign against a coast fortress will be opened by some form of reconnoissance, but with the understanding that if the fortress is taken unawares the attack will be pressed home with utmost vigor.

A reconnoissance may be for any one of the following purposes:

- (a) In general to locate the lay of land at the harbor entrance, lighthouses, islands, etc., prominent landmarks, etc.
- (b) To locate position of batteries, arcs of fire, dead angles, etc.
- (c) To locate range-finding stations, base-end stations, aiming points, signal stations, etc.
- (d) To locate mine fields.
- (e) To locate searchlight positions.
- (f) To locate landing places for mobile troops.
- (g) To determine the naval resources of the port.

In the general reconnoissance no particular type of craft may be expected, but it will be made at the beginning of the campaign and will be conducted at as extreme a range as is possible, consistent with its mission.

For the purpose of locating the positions of batteries, dead angles, arcs of fire, etc., it will usually be necessary for the attacking fleet to show sufficient strength and to so act as to draw the fire of the defense. To this end powerful armored vessels, probably fast battleships, armored cruisers, or coast-defense vessels, will be used. For the attack to accomplish the best results the fortress commander must be led to believe that a serious attack is pending.

To locate the position of the range-finding, base-end stations, etc., small fast cruisers, destroyers, trawlers, or submarines (awash) may be employed. Small patrols may be landed with a view to supplementing information obtained from other sources.

To locate mine fields, destroyers, trawlers, or submarines may be used.

To locate searchlights, fast vessels, cruisers, destroyers, or submarines may be used, the attack being supported by a bombardment from beyond the illuminated areas.

To locate landing places for mobile troops, which may or may not be in the field of fire, destroyers, small cruisers, or steam launches may be employed.

To determine the naval resources of the defended port, it may be necessary to effect the passage of the fortifications at night, in which case submarines may be used. Small patrols landed from the attacking fleet can supplement the information obtained in other ways.

Raids.—A raid may be for one of the following purposes:

- (a) To destroy range-finding stations, base-end stations, signal stations.
- (b) To destroy searchlights.
- (c) To destroy and open a breach in the mine field.

A raid to destroy range-finding stations, base-end stations, etc., will be made in the daytime by fast vessels mounting a numerous rapid-fire armament.

A raid on searchlights will be made at night by fast light cruisers or destroyers, acting singly or in groups, and may be supported by a feint by heavy ships with a view of creating a diversion and bring the searchlights into action.

A raid on the mine field will usually be made under cover of a heavy fire at night. Destroyers specially equipped for sweeping, trawlers, or submarines will be used. It is desirable that the attention of the defense be distracted by feints in other points of the battle area.

Blocking the entrance.—Attempts to close the entrance to the harbor by blocking operations can only be expected in those harbors where the entrance is very narrow. The attempts at Santiago and Port Arthur are familiar examples. For this attack, merchant steamers especially prepared for the purpose will be used. This form of attack will be particularly effective where the harbor entrance is narrow, as at the entrance to the canal.

Blockade.—The establishment of a blockade may be looked for at the beginning of the campaign. It will have two objects in view, viz, to seal the harbor entrance to ingress and egress; and, by having at all times of the day and night a naval force immediately in front of the fortifications ready to strike at a moment's notice, to hold a large part of the garrison at the armament and to harry and wear it down by incessant feints. To accomplish these purposes no fixed type of vessel can be expected, but the establishment of the blockade and its purpose will soon be evident to the defense.

Bombardment.—This form of attack may be used alone or in conjunction with some other form when its real purpose will be in the nature of a covering movement, made with the intention of distracting the defense's attention to the main attack. Capital ships with high-power, long-range guns will be used.

Runby.—This form of attack, except for small vessels, will not be expected until after an attempt has been made to locate the mine fields and breach an opening in them. There are some harbors where the entrance is very wide and deep where successful mining operations will be difficult, if not impossible, and where broad and deep inland waters are available to the fleet after passing the forts. Cape Henry,

Long Island Sound, Manila Bay, and Puget Sound are examples. These harbors seem to invite a runby. There are other harbors where a runby is not practicable, as there are no inner waters in rear of the fortifications available. Each harbor must be carefully studied with a view to determining if a runby can be made.

Probable form of attack.—Each individual harbor should be carefully studied from the point of view of the attack, to determine what particular form of attack is most likely to be successful, and the most effective method of meeting it should be decided upon. The coast-defense commander should be constantly on the alert to recognize quickly such an attack at its inception and to apply the proper remedy.

CHAPTER VII.

ESTIMATING THE SITUATION.

Paragraph 290, Drill Regulations of the Coast Artillery Corps, reads as follows:

Before becoming committed to any form of defense he must understand the intentions of his opponents and consider the different courses of action open to the defense, with the advantages and disadvantages of each, and rapidly arrive at a clear and definite decision as to the best method of defense.

The mental process by which the senior fort commander arrives at this clear and definite decision is called "estimating the situation." The importance of its application to writing field orders for mobile forces has long been manifest, but such application to an engagement between ships and shore defenses is of but recent development. Such application is nevertheless of supreme importance. In no other form of land warfare do targets move at such great speed as in an engagement between ships and forts, under no other conditions may the action be of so short a duration that an initial error may be the price of victory. For example, assume a runby at night at great speed to be attempted. Here a speed of 28 knots is not impossible. Assume the maximum range of the searchlights to be 7,500 yards. The elapsed time between the discovering of the target and the time it is abreast of the battery and can bring to bear its superior volume of rapid fire is about nine minutes. Not less than three minutes must elapse from the time the senior fort commander decides to open fire with a particular battery until the first shot arrives at the target, and it can be seen that an initial error in estimating the situation and in the original assignment will result in great loss of gun power. The importance then of rapidly and accurately estimating the situation is manifest.

The mental process of estimating the situation in a coast artillery engagement is analogous to those in which mobile forces are engaged.

In the beginning of this training, after considering each of the headings, the estimate should be carefully reduced to writing. After the headings are thoroughly understood, the written estimate may be dispensed with and the solution estimated orally. The mind works rapidly in accustomed channels, and what was formerly a laborious and difficult mental operation can be rapidly and accurately performed.

The Coast Artillery War Game is peculiarly suitable to giving this class of instruction. The instructor arranges the opening stage of a given form of attack, which should always have a definite purpose in view, i. e., as reconnoissance, raid on stations or on searchlights, bombardment, runby, etc., and indicates by whips of cotton which ships are firing and the targets at which they have opened. The speed of each division should also be announced. For use at the critique the courses of the ships should be traced by the instructor on a small map of the harbor. After these preliminary arrangements have been made, the curtain should be drawn, revealing for the first time of the view of the war-game board. The instructor should then read the general and special situations involved, and announce the state of weather, the time of day, and the tide. The curtain should remain drawn for five minutes, during which time the students, using field glasses, should carefully study the marine picture presented. At the end of five minutes the curtain should be drawn and each member required to estimate the situation under the following heads:

- (1) Mission of the defense.
- (2) Enemy's forces.
 - (a) Number, class, and formation of approaching ships.
 - (b) Speed and course.
 - (c) Hydrography of harbor.
 - (d) Probable intentions.

- (3) Our forces.
 - (a) Location and character of fire commands.
 - (b) Location and strength of mine commands.
 - (c) Location, number, and efficiency of searchlights.
 - (d) Location and strength of artillery supports.
 - (e) Amount and kind of ammunition remaining on hand.
- (4) State of weather, wind, and tide.
- (5) Decision.
- (6) Order to carry out decision.

Mission of the defenses.—It is of utmost importance that the senior fort commander should clearly understand the mission of the defenses. This is not always evident from a cursory examination of the defense, and it may require considerable study to determine what the mission is. Furthermore, the mission of any given defense may be effected by the general situation (i. e., the possible arrival of a relieving fleet, the limited amount of available ammunition, etc.).

Some fortifications are located to defend naval bases, others to protect commercial centers, or to deny to the enemy the use of certain harbors as possible bases, or the use of certain interior waters, etc. A careful study should be made of each locality to determine which particular form of naval attack is most likely to succeed, and consequently which is most to be feared, and the commander should be constantly on the watch for the development of that particular form of attack which is most likely to succeed.

Enemy's forces.—Under this head must first be considered the number, class, and formation of the approaching ships. These considerations will often be a guide in deciding what the enemy's plans are and the character of the ships will determine what class of weapon (gun, mortar, or mine) should be employed by the defense. Their formation will indicate the possible development of hostile fire.

Their speed and course will determine the length of time under fire, and their course will decide the angle of presentment (of armor) best suited to attack by the various batteries.

The hydrography of the harbor will determine whether their present course can be continued or whether some change therefrom will be necessary. It will also limit vessels of certain draft to fixed avenues of approach.

Probable intentions of the enemy will have a most important bearing on the decision of the senior fort commander and will often indicate his best line of defense. For example, if the intentions of the enemy be a reconnoissance to locate unknown or invisible batteries, it would manifestly be unwise for the defense to reveal their position until the ships are well within effective range and in such position that damage might be inflicted on them. Similarly during a night attack, in a reconnoissance for the location of searchlight positions, it would obviously be unwise to place in action searchlights whose location are unknown to the enemy unless compensating return be obtained therefor. In a similar manner other and equally obvious examples might be cited showing the necessity for the senior fort commander deciding upon the probable intentions of the enemy before committing himself to any line of action.

Our own forces.—The location and composition of fire commands (i. e., whether major-caliber guns, mortars, intermediate or minor caliber guns) will directly enter in any assignment of target. The location of the fire command will also determine whether a given target is within the field of fire of any particular battery.

Under this heading should also be considered whether previous engagements have affected the personnel or the matériel of any component fire command.

The strength and location of mine commands.—The location of the mine fields will indicate to the senior fort commander whether they are placed as an obstacle to hold an enemy under fire or to be used as a last resort in denying entrance to the inner

harbor. Consideration must be given to damages due to previous engagements or to certain mines or groups which test badly.

Number, location, and efficiency of searchlights.—These considerations, which have application only in a night operation, are ones that invite most careful consideration, and perhaps no more difficult problem confronts the senior fort commander than the choice and use of searchlights, especially when it is recalled that a searchlight injudiciously used may do more harm than good by blinding gunners and observers. Account must also be taken of the damages resulting from previous engagements and to the effect on range due to the atmospheric conditions on the occasion in question.

The strength and location of artillery supports has a bearing where possible landings from naval ships may be contemplated.

Amount and kind of ammunition remaining on hand.—In view of the limited number of rounds in the battle reserve this is a most serious consideration, and the senior fort commander must weigh well the probabilities of getting adequate return for any expenditure thereof. The question of expenditure of ammunition is intimately connected with the general situation due to the very limited amount of ammunition available.

Wind, weather, and tide.—These considerations affect the possible movement of the hostile ships, their speed, the range of searchlights, the accuracy of gun fire, and the blinding effect of the sun in the gunner's eyes.

Decision.—The senior fort commander is now in a position to consider the various courses of action open to him with the relative advantages and disadvantages of each and is ready to come to a clear, definite decision which is expressed by his tactical orders.

The orders to carry out the tactical decision.—The tactical orders of the senior fort commander are communicated to fort (or fire) commanders by telephone. They should be succinct and as brief as possible. As far as possible they should be in general terms and should not deny the next lower commander the choice of how best to execute his superior officer's commands.

In rare occasions only will it be necessary for fort commanders to assign individual ships to particular batteries. In general the senior fort commander will determine when or at what range lights or batteries will be placed in action, what areas are to be searched, and what group of ships will be attacked, the particular ship and the particular battery of the fire command to open fire being selected by the fire commander.

The following are given as typical commands for senior fort commander (Warren):

Andrews: Target, Graves; Battle cruiser division going north; Fort commanders action.

Heath: Target, broad; Dreadnaught division, line abreast, fire when in range (or fire at 10,000 yards).

No. 10: Search Allerton and Graves and report.

Strong: Mine commanders' action.

CHAPTER VIII.

DEFINITIONS: SHIPS IN GENERAL.

Abaft: Toward the stern of the vessel.

Abeam: In line with the widest portion of the vessel.

Aft: Near the stern, or behind the vessel.

Amidship: The central part of the vessel, either with regard to length or breadth.

Anchorage: A place suitable for anchoring a vessel, or where a vessel is at anchor, or where vessels are accustomed to anchor.

Astern: At any point behind; away from the ship in the direction opposite to her course; backward.

Awash: Lying nearly parallel with the surface of the water, permitting submergence at intervals in whole or in part by the action of the waves.

Ballast: Heavy material, such as iron, lead, bags of sand or shot, barrels or tanks of water, carried in the bottom of a ship to steady her or prevent her leaning over too easily when the wind blows against her side or sails.

Bark: A three-masted vessel with square sails on the fore and mainmasts and fore-and-aft sails on the mizzen.

Barkentine: A three-masted vessel with square sails on the foremast and fore-and-aft sails on the main and mizzen mast.

Battens: Strips of wood or flat iron bars used to fasten down the tarpaulins covering hatches.

Beam: The widest portion of a vessel's hull.

Bearing: The direction of an object with relation to a ship's head as distinguished from absolute (or compass) bearing, which is with relation to the north pole.

Belay: To fasten a rope around a cleat or belaying pin.

Bell: The ship's bell is rung in a certain way at sea to indicate the time, every half hour. At noon, by observation, eight strokes are given in four pairs of strokes; at 12.30, one stroke; at 1 o'clock, two strokes; at 1.30, two strokes, and after a short pause a third stroke; at 2 o'clock two pairs of strokes, and so on to 4 o'clock, when four pairs of strokes, or "eight bells," are sounded. From 4 o'clock to 6 o'clock and from 6 o'clock to 8 o'clock are the first and second "dog watch," and in these the greatest number of strokes is four bells; but after that the bells are rung in the usual way until the following noon.

Belt: Armor covering water-line area about 15 feet wide, 5 feet of which is below the water line, extending in some cases the entire length of the ship, of maximum width and thickness opposite the machinery and magazine spaces and tapering in width and thickness at the bow and stern.

Bilge: A ship's bottom, extending from the keel to the beginning of the curve of the sides.

Bilge keel: Finlike ribs projecting from the outer bilge on some ships to prevent rolling.

Binnacle: The stand for the compass by which the vessel is steered.

Boom: The spar on which a fore-and-aft sail is fastened on the lower edge.

Bow: The front portion of a vessel. The right is the starboard bow, the left the port bow.

Bowprit: The main spar projecting from the bow of the vessel. It supports the booms on which the outer jibs are spread and serves to fasten the stays, which, stiffened by bobstays, run to the cutwater.

Bridge: An athwartship platform, usually forward of mainmast, connected with chart room and conning tower. The captain and navigating officers take station on the upper bridge, or bridge proper. All signals are made or hoisted from the lower bridge.

Brig: A two-masted vessel with square sails on both masts. A hermaphrodite brig, which is in British practice called a brigantine, has square sails on the foremast only.

Brigantine: A two-masted vessel square rigged on both masts, but with a fore-and-aft mainsail. It differs from a hermaphrodite brig in having a square topsail on the mainmast.

Bulkhead: A traverse or longitudinal partition which separates one part of a vessel from another. A collision bulkhead, of extra thickness and strength of construction, and water-tight, is placed in a war vessel a short distance abaft the stem to take the force of a collision and to prevent the crumpling of the midship section.

Bunker: A large fixed receptacle, as a bin or the like; especially, a coal bin on a ship.

Cable: The rope or chain attached to an anchor.

Capstan: A mechanism for applying power on shipboard, consisting of a vertical cylinder operated either by power or by hand.

Chart room: The captain's office at sea, usually on or near the bridge.

Clew: The lower corner of a sail.

Close-hauled: Sailing close to the wind.

Complement: Full or complete number, allowance, or amount, as of men; as, the vessel has her complement of men.

Conning tower: A small, heavily armed ship-control station forward of the foremast.

Crow's nest: A barrel-shaped lookout place on the foremast, usually accommodating two men.

Davits: Steel or iron cranes, usually fitted in pairs at the sides of a ship, for raising and lowering boats from and to the water.

Dead reckoning: A method of estimating the approximate position of a vessel at sea from the course steered and the distance run; used in times of heavy weather or protracted fog.

Displacement: The weight of water displaced by a body floating in it, as a vessel, this weight being equal to the weight of the body.

Division: Four (usually) naval vessels associated together for administration and operations.

Draft: The depth to which a vessel sinks in the water, especially when laden; as, a vessel of 18 feet draft.

Easting: The degrees of longitude when sailing eastward.

Ebb tide: The falling tide.

Fairway: The middle of a navigable strait, channel, or harbor.

Fathom: Six feet; used in designating depth of water.

Fender: A wooden beam usually swinging at the side of a pier or dock to prevent ships chafing against them. Globular shaped plaited rope, or pudding fenders, are generally used when a vessel is moving alongside another or a landing stage, to lessen the shock of contact.

Fleet: Two or more squadrons.

Flood tide: The rising tide.

Flotilla: Two or more divisions of destroyers, torpedo boats, or submarines.

Flotsam: Goods thrown into the sea from a ship and still afloat.

Fore-and-aft: Lengthwise with the ship.

Forecastle: The portion of the open deck of a ship from the foreshrouds forward. Also the living space of the crew.

Forward: Toward the bow of the vessel.

Funnel: Smokepipe of a naval vessel; used in artillery commands because of ease of transmission over the telephone.

Gaff: A spar used to extend the upper edge of a quadrilateral fore-and-aft sail. A gaff topsail is a fore-and-aft topsail which is hauled down to the peak of the gaff, as opposite to a club topsail, which is set on its own boom or club.

Gross tonnage: The total designed weight of a vessel, including the estimated weight of hull, machinery, armor, armament, water, stores, and coal.

Guard ship: Ship designated daily to perform certain duties; designated by flying from the foremast a white flag with five clubs (at night a red light at the foremast).

Gunwale: The top of the sides of a boat.

Half deck: Forecastle deck; a half-decked boat is one only partially decked.

Half-mast: To set a flag midway between the truck and the lower masthead as an indication of death or a token of respect.

Hatch: An opening in a deck for passengers or cargo; one with a sliding top is a "booby hatch."

Hurricane deck: The topmost deck in a large steamship.

Jetsam: Goods thrown overboard and washed ashore.

Jib: One of the triangular headsails of a vessel. From the foremast forward the jibs are inner jib or foretopmast-staysail, outer jib, jib topsail, flying jib, and flying jib topsail.

Jigger mast: The fourth mast in a vessel.

Jury: Temporary makeshift, as a jury mast.

Keel: The central longitudinal beam at the extreme under side of a vessel; the foundation of the entire structure.

Knot: 6,080.27 feet, equals $1\frac{1}{4}$ land miles. (NOTE.—One-half the speed in miles per hour equals yards per second.)

Lee: The side of a vessel or land opposite that against which the wind blows.

Lee shore: Shore on the lee side of a ship.

Leeway: The sideways movement of a vessel when the wind is blowing on her side.

Length: The length on the load water line, including the overhang of the stem at this line.

List: To lean to one side.

Load line: The depth to which a ship may be loaded, indicated by a white circle with a white line through it, painted on the outside of every ship, called the Plimsoll mark.

Log: An apparatus used to determine the speed of a vessel. A ship's log is the official daily record of the proceedings on board ship, weather, wind, distance traveled, etc.

Mast: A stick or spar of round timber or tubular iron or steel, set upright in a vessel to sustain the yards, booms, sails, etc. Lower sails are usually stepped on the keelson of a vessel, and set slightly raking toward the stern; sometimes they are made in one piece, but more commonly in several pieces and bound together, being called made, built, or built-up masts. Above the lower mast of a sailing ship comes the topmast, and above that again the topgallantmast and royal mast, the two latter generally in one pole. The position of each pole is further indicated by a prefix, as foremast, foretopmast, foreroyal mast, mainmast, maintopmast, etc., mizzenmast, mizzenmast, etc. The foremast, as its name indicates, is in the fore part of the ship, the mainmast is in the center, and the mizzenmast is nearest the stern.

Mizzen: The third mast of a vessel, counting from the bow.

Painter: A rope with which to fasten a boat by its bow.

Peak: The upper after corner of a quadrilateral fore-and-aft sail; also the end of the gaff.

Pilot house: Sheltered position connected with the bridge and from which the vessel is steered.

- Point:** One of the 32 divisions of the compass, equals $11\frac{1}{4}$ degrees.
- Poop:** A raised deck at the after end of a vessel.
- Port:** The left side of a vessel when looking forward.
- Quarter deck:** The after part of the spar (or upper) deck.
- Rake:** To incline, as the inclination of masts from a vertical line.
- Raking:** Sloping masts not upright are said to rake or slant backwards.
- Reef:** To reduce a sail by tying a part of it by small ropes called reef points.
- Royal:** The yard and sail above the topgallant sail in a square-rigged vessel; the fifth from the deck in a double topsail rig.
- Schooner:** A purely American vessel with fore-and-aft sails.
- Scuppers:** Drainage gutters along the decks at the rails.
- Scuttle:** To sink a ship by cutting a hole in her.
- Sheets:** The ropes by which the sails are worked.
- Ship:** A large seagoing vessel; specifically, a large vessel with bowsprit and three or more masts, each of which carries square sails. From the deck upwards the sails are mainsail, lower topsail, upper topsail, topgallant sail, royal, and occasionally skysails. From the bow aft the masts are foremast, mainmast, and mizzenmast. Built-up masts consist of the mainmast, topmast, topgallant mast, and royal mast, the latter two being generally in one pole.
- Shrouds:** Steel wire ropes extending from the mast to the sides of a ship to hold the masts steady.
- Skysails:** The next sail above the royals; only used when there is very light air and that mainly aloft.
- Soundings:** The depth of water expressed in fathoms and measured by means of a sounding line.
- Spanker:** The fore-and-aft sail on the mizzenmast of a square-rigged ship; also the fourth mast and sail of a schooner.
- Squadron:** Usually two divisions of naval vessels.
- Stanchion:** Wooden or steel uprights supporting a deck or handrail.
- Starboard:** The right-hand side of a vessel looking forward.
- Stays:** Ropes supporting a mast and leading in the direction of the length of the vessel.
- Stem:** The extreme end of a vessel forward; the portion which makes an entrance into the water for the body of the ship.
- Stern:** The extreme end of a vessel aft.
- Tack:** To change the direction when sailing to windward. A vessel with the wind on the starboard side is on the starboard tack; and with the wind on the port side is on the port tack.
- Thwartship:** Crosswise of the ship.
- Topgallant mast:** The mast next above the topmast in a square-rigged vessel.
- Topmast:** The mast next above the lower mast in a square-rigged vessel, and the smaller and upper mast in a fore-and-aft vessel.
- Topsail:** The sail above a lower sail or course. Topsails were formerly made in one piece, but they are now made in two pieces, each of which can be set or furled independently of the other. The upper topsail is hoisted on its yard to the masthead, while the lower topsail drops from its stationary yard to the lower yard. Fore-and-aft topsails are either hoisted to the masthead and hauled out to the end of the gaff or hoisted from the deck bent to a small yard.
- Truck:** A circular piece of wood affixed to the top of a mast and through which the flag or signal halliards are rove.
- Watch:** See under "Bells." On duty
- Weather side:** Side of vessel toward the wind.
- Yards:** Spars placed crosswise in square-rigged ships to which the sails are fastened.

CHAPTER IX.

GENERAL INFORMATION.

I. FLAGS, SIGNALS, LIGHTS, ETC.

President's flag.—The flag of the President shall be of blue bunting, with the official coat of arms of the United States of suitable size in the center, and shall be 10.20 feet hoist, 14.40 feet fly. (Par. 217, A. R., 1913.)

Secretary of War's flag.—The flag of the Secretary of War shall be of scarlet bunting, measuring 12 feet fly and 6 feet 8 inches hoist. In each of the four corners shall be a five-pointed white star with one point upward. * * * In the center of the flag shall be the official coat of arms of the United States, of suitable size. (Par. 219, A. R., 1913.)

Assistant Secretary of War's flag.—Same as the Secretary of War's flag, except that the field is white and the stars are scarlet. (Par. 221, A. R., 1913.)

Secretary of the Navy's flag.—Rectangular flag of blue bunting, with white vertical foul anchor in center and four white stars, one in each corner.

Assistant Secretary of the Navy's flag.—Rectangular flag of white bunting, with blue anchor in center, with four blue stars, one in each corner.

Flag of a Rear Admiral, United States Navy.—Rectangular blue flag, with two white stars on the vertical central line. When two or more flag officers of the same grade meet, the senior only flies the blue flag; all others fly a red flag.

Flag of Chief of Coast Artillery or brigadier general.—Rectangular flag of scarlet bunting, with one white star in center. Flag of major general has two stars on the central horizontal line. (Par. 240, A. R., 1913.)

Coast-defense commander's flag.—Rectangular flag of scarlet bunting, with Coast Artillery Corps device in yellow. (Par. 240, A. R., 1913.)

Fort commander's flag.—Small triangular pennant of bunting, the third nearest staff blue with 13 stars, remaining two-thirds scarlet.

District engineer officer's flag.—Rectangular flag of scarlet bunting, with Engineer Corps device in white at center.

Naval Militia flag.—Blue rectangular flag with blue anchor on yellow lozenge at center.

Battle efficiency pennant.—Red triangular pennant with black ball in center flown from foremast.

Coast-Guard cutter flag.—Rectangular flag, consisting of 16 red-and-white vertical stripes, with a red stripe next to the flagstaff, the union bearing the coat of arms of the United States in dark blue on a white field. This flag is flown from the fore of all revenue cutters.

Storm signals are displayed by the United States Weather Bureau at 141 stations, situated along the Atlantic and Gulf coasts, and at 27 stations, situated along the Pacific coast of the United States.

Storm-warning flags.—A red flag with a black center indicates that a storm of marked violence is expected. The pennants displayed with the flags indicate the direction of the wind; red easterly (from northeast to south); white, westerly (from southwest to north). The pennant above the flag indicates that the wind is expected to blow from the northerly quadrants; below, from southerly quadrants. By night,

a red light indicates easterly winds, and a white light above a red light westerly winds.

Hurricane warnings.—Two red flags with black centers, displayed one above the other, indicate the expected approach of tropical hurricanes, and also of those extremely severe and dangerous storms which occasionally move across the Lakes and northern Atlantic coast. Hurricane warnings are not displayed at night.

Colors in United States Navy.—At morning "colors," at 8 a. m., the band plays the Star-Spangled Banner, at the beginning of which the ensign is started up and hoisted smartly to the peak or truck. All officers and men face the ensign and stand at attention, and the guard of the day and sentries under arms come to the position of "present" while the national air is being played. At the end of the national air, all officers and men salute, ending the ceremony. When no band is available, the field music sounds the "colors" call in place of the national air. Honors to foreign ensigns are rendered in the same manner, substituting the appropriate national air.

The same ceremonies are observed at sunset "colors," the ensign being started from the peak or truck at the beginning of the Star-Spangled Banner. The ensign is not lowered hurriedly.

Upon hoisting the ensign at sunrise the usual honors and ceremonies are paid, and they are not repeated at 8 a. m.

NAVAL NOTES.

A ship of the Navy entering port at night hoists her ensign at daylight for a short period to enable the authorities of the port and ships of war present to determine her nationality. It is customary for other ships of war to show their colors in return.

At night when approaching an anchorage where men-of-war are likely to be found, all ships hoist at the peak two white lights in a vertical line. The ships at anchor reply by hoisting the same signal.

The distinctive mark of a ship of the Navy in commission, other than the national ensign, is a flag or pennant at a masthead.

The distinctive flag of the senior officer on board is displayed day and night, and is carried at the main, except the flag of a rear admiral and pennant of a senior officer present, which are carried at the aftermast and starboard afteryard arm, respectively.

When in a port of the United States, a flag officer is absent from his command afloat for a period exceeding 24 hours, his flag is hauled down, and the command devolves upon the line officer next in rank present in the fleet, squadron, or division, subject to any directions from the flag officer.

If a flag officer is absent from his flagship at night with the intention of returning within 24 hours, his absence is indicated by three white lights displayed at the peak in a vertical line.

Every flagship, when in port or when at sea in company with other ships, carries two white lights in a horizontal line on the afterside of the aftertop from sunset to sunrise. These lights are not, however, carried at the same time as the lights indicating the absence of a flag officer.

To half-mast the ensign.—In half-masting the ensign it is, if not previously hoisted, first hoisted to the peak or truck with the usual ceremonies, and then lowered to half-mast. Before lowering from half-mast it is first hoisted to the truck or peak and then lowered with the usual ceremonies.

Dipping the flag.—This is a form of salute or courtesy, sanctioned by international usage, and employed by ships of commerce toward other ships and between such ships and the shore.

No ship of the Navy lowers her sails or dips her ensign unless in return for such compliments.

When any vessel salutes a ship of the Navy by dipping her national ensign, it is returned dip for dip. If before 8 a. m. or after sunset the colors are hoisted, the dip returned, and, after a suitable interval, the colors hauled down.

The flag of a military post is not dipped by way of salute or compliment.

Position of ensign to denote if ship is at anchor or under way.—Vessels of the United States Navy at anchor display the national ensign at the after staff and the union jack at the bow between 8 a. m. and sunset; also between sunset and 8 a. m., when coming to anchor or getting under way or when it becomes necessary to return the dip of a commercial ship.

Vessels of the United States Navy under way display the national ensign at the gaff on the rear mast.

The union jack.—When at anchor the union jack is flown from the jack staff from morning to evening colors.

The jack hoisted at the fore is a signal for a pilot. A gun may be fired to call attention to it.

The jack hoisted at the mizzen, or at a yardarm, denotes that a general court-martial or court of inquiry is in session. It is hoisted (and, if in port, a gun fired) when the court meets and hauled down when the court adjourns.

Meal pennant.—A red pennant is hoisted at the yardarm during the time the crew is at meals on board vessels at anchor, whether or not the colors are hoisted. This pennant is shown for this purpose without reference to the flagship.

At sea or under way, in formation, it is used as reserve-speed pennant.

This pennant is of interest to the Coast Artillery as showing when not to make boarding visits.

Speed cones.—Speeds for division and fleet maneuvers are "full," "standard," two-thirds (standard), and one-third (standard). The "standard" speed is fixed by the admiral's order for the ships to get under way. "Full" speed is one knot greater than "standard."

During the day, when under way, the speed of each ship is indicated by a colored black, yellow, or red cone, $2\frac{1}{2}$ feet at base and 3 feet in height.

The meanings of the various positions of the speed cones are as follows:

(1) Hoisted at starboard (or port) yardarm, apex up—"Starboard (or port) engine going ahead at standard speed."

(2) Hoisted one-third (or two-thirds) of the way to starboard (or port) yardarm, apex up—"Starboard (or port) engine going ahead at one-third (or two-thirds) of standard speed."

(3) Lowered out of sight—"Engine stopped."

(4) Hoisted part way to starboard (or port) yardarm, apex down—"Starboard (or port) engine backing at a speed proportional to height of cone."

(5) Hoisted at starboard (or port) yardarm, apex down—"Starboard (or port) engine backing at full speed."

(6) The reserve-speed (meal) pennant hoisted at the yard next to the speed cone (apex up), indicates "Going ahead at full speed, or more than full speed."

Whistle signals for vessels passing or crossing.—(1) One short blast means that the port sides of the two vessels are to pass each other.

(2) Two short blasts mean that the starboard sides of the two vessels are to pass each other.

NOTE.—This rule can be remembered by the fact that one blast means one syllable (port), two blasts two syllables (starboard).

The vessel that whistles first has the right of way.

Steam vessels.—A steam vessel when under way shall carry:

(a) *Masthead light.*—On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel, a bright white light so constructed as to show an unbroken light over an arc of the horizon of 20 points of the compass, so fixed as to

throw the light 10 points on each side of the vessel, namely, from right ahead to 2 points abaft the beam on either side, and of such a character as to be visible at a distance of at least 5 miles.

(b) *Side lights*.—On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of 10 points of the compass, so fixed as to throw the light from right ahead to 2 points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least 2 miles.

On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of 10 points of the compass, so fixed as to throw the light from right ahead to 2 points abaft the beam on the port side, and of such a character as to be visible at a distance of at least 2 miles.

The said green and red side lights shall be fitted with inboard screens projecting at least 3 feet forward from the light so as to prevent these lights from being seen across the bow.

(c) *Range lights*.—A seagoing steam vessel when under way may carry an additional white light similar in construction to the light mentioned above in subdivision (a). These two lights shall be so placed in line with the keel that one shall be at least 15 feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

Steam vessels when towing.—A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line, one over the other, not less than 3 feet apart, and when towing more than one vessel shall carry an additional bright white light 3 feet above or below such lights, if the length of the tow measured from the stern of the towing vessel to the stern of the last vessel towed exceeds 600 feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white masthead light or the after range light mentioned above.

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

Lights for sailing vessels and vessels in tow.—A sailing vessel under way or being towed shall carry the same lights as are prescribed for a steam vessel under way, with the exception of the white lights mentioned, which they shall never carry.

Anchor lights.—A vessel under 150 feet in length when at anchor shall carry forward, where it can best be seen, but at a height not exceeding 20 feet above the hull, a white light in a lantern so constructed as to show a clear, uniform and unbroken light visible all around the horizon at a distance of at least 1 mile.

A vessel of 150 feet or upward in length when at anchor shall carry in the forward part of the vessel, at a height of not less than 20 and not exceeding 40 feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than 15 feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

Sound signals for fog.—All signals prescribed by this article for vessels under way shall be given:

1. By steam vessels on the whistle or siren.
2. By sailing vessels and vessels towed, on the fog horn.

The words "prolonged blast" used in this article shall mean a blast of from four to six seconds' duration.

A steam vessel shall be provided with an efficient whistle or siren, sounded by steam or some substitute for steam so placed that the sound may not be intercepted by any obstruction, and with an efficient foghorn; also with an efficient bell. A sailing vessel of 20 tons gross tonnage or upward shall be provided with a similar foghorn and bell.

In fog, mist, falling snow, or heavy rainstorm, whether by day or night, the signals described in this article shall be used as follows, namely:

(a) *Steam vessel underway*.—A steam vessel underway shall sound, at intervals of not more than one minute, a prolonged blast.

(b) *Sail vessel underway*.—A sailing vessel underway shall sound, at intervals of not more than one minute, when on the starboard tack, one blast; when on the port tack, two blasts in succession; and when with the wind abaft the beam, three blasts in succession.

(c) *Vessels at anchor or not underway*.—A vessel, when at anchor shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(d) *Vessels towing or towed*.—A steam vessel, when towing, shall, instead of the signals prescribed above ("steam vessel underway"), at intervals of not more than one minute, sound three blasts in succession, namely, one long blast followed by two short blasts. A vessel towed may give this signal, and she shall not give any other.

Speed in fog.—Every vessel shall, in a fog, mist, falling snow, or heavy rainstorm, go at a moderate speed, having careful regard to the existing circumstances and conditions.

Steam vessel shall keep out of the way of sailing vessel.—When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision, the steam vessel shall keep out of the way of the sailing vessel.

Narrow channels.—In narrow channels every steam vessel shall, when it is safe and practicable, keep to that side of the fairway or mid-channel which lies on the starboard side of such vessel.

Distress signals.—When a vessel is in distress and requires assistance from other vessels or the shore, the following shall be the signals to be used or displayed by her, either together or separately, namely:

In the daytime—

A continuous sounding with any fog-signal apparatus, or firing a gun.

At night—

(1) Flames on the vessel as from a burning tar barrel, oil barrel, etc.

(2) A continuous sounding with any fog-signal apparatus, or firing a gun.

International code signals of distress are:

(1) The International Code signal of distress indicated by NC.

(2) The distant signal, consisting of a square flag, having either above or below it a ball, or anything resembling a ball.

(3) The distant signal, consisting of a cone point upward, having either above it or below it a ball, or anything resembling a ball.

The provisions of the Berlin International Radiotelegraphic Convention, proclaimed by the President on May 25, 1912, prescribe that ships in distress use the signal "— — — — —" (SOS in the Morse International Code) repeated at brief intervals.

II. FLEET FORMATIONS.

The diagram facing this page shows the various formations of a squadron of eight ships:

III. CLASSIFICATION OF SHIPS.

Vessels may often be identified by description, using the number of funnels and masts as basis of classification as, e. g., class "1-2," where the first digit "1" indicates the number of funnels, and the second digit "2" the number of masts. Other examples are given in figure 20.

IV. SYMBOLS FOR WARSHIPS.

The following table gives abbreviations used to indicate the various vessels. By employing the method, time and labor in writing orders, etc., can be saved.

Table of types.

Type.	Name.
AA.....	Dreadnaught.
A.....	Battleship, first class.
N.....	Battleship, second class.
BB.....	Battle cruiser.
B.....	Armored cruiser.
M.....	Monitor.
C.....	Cruiser, first class.
F.....	Cruiser, second class.
S.....	Scout, Naval.
VV.....	Destroyer.
T.....	Torpedo boat.
E.....	Merchant scout.
SM.....	Submarine.



FIGURE 20.—CLASSIFICATION OF SHIPS.

V. SILHOUETTES OF WARSHIPS.

The following silhouettes give the characteristics of various types of warships, and will be found useful in the preliminary instruction given with the balopticon as outlined in the battery commander's course:

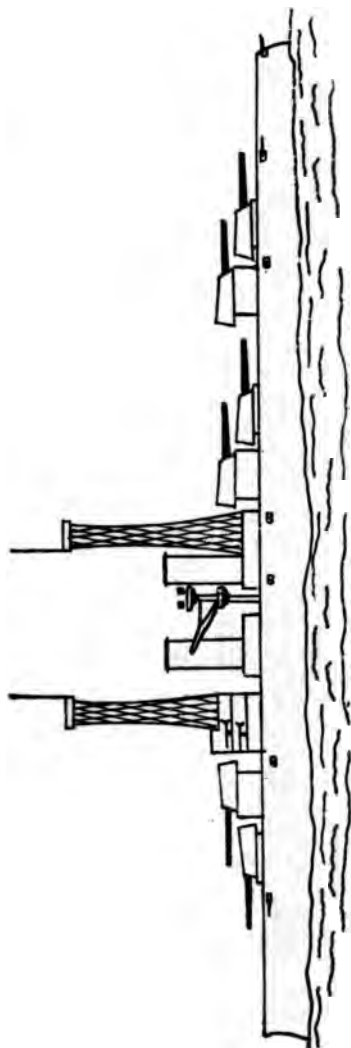


FIGURE 21.—U. S. DREADNAUGHT "WYOMING."

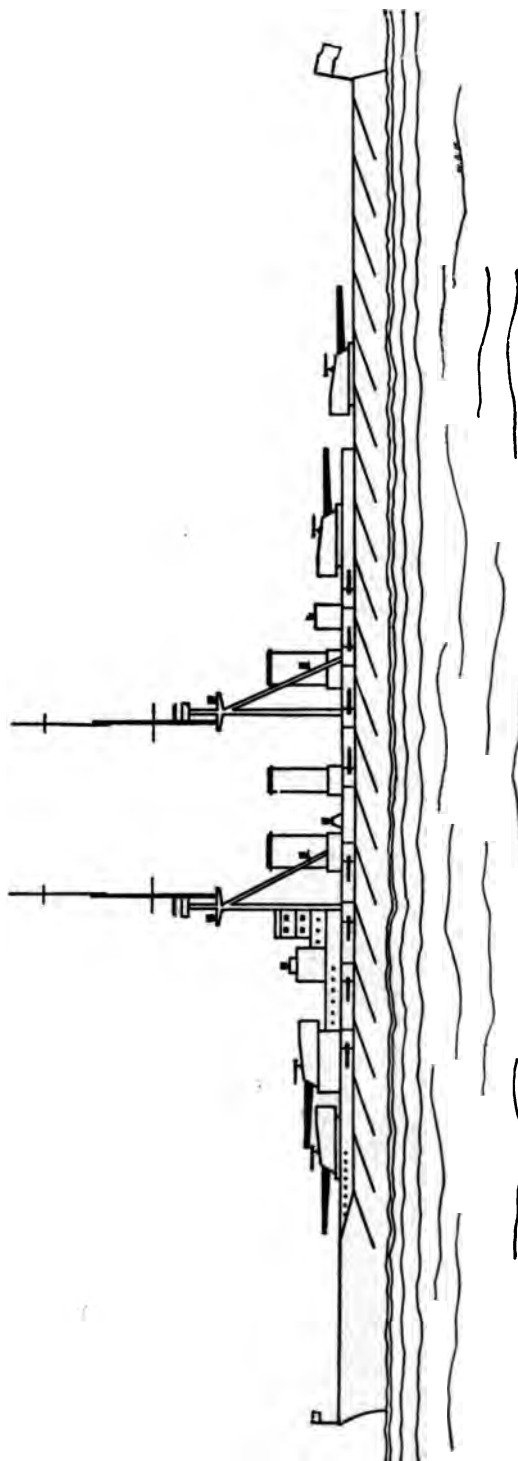


FIGURE 22.—JAPANESE BATTLE CRUISER "KONGO."

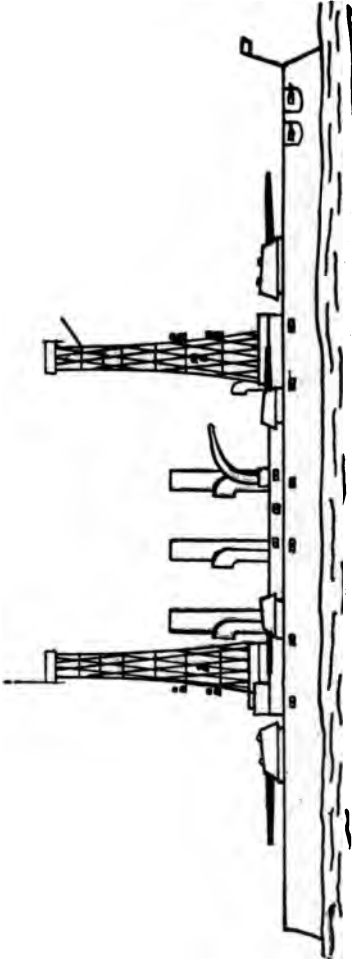


FIGURE 23.—U. S. BATTLESHIP CONNECTICUT.

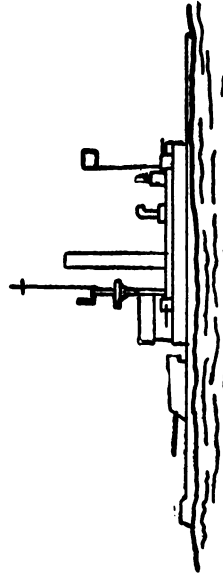


FIGURE 24.—U. S. MONITOR "TALLAHASSEE."

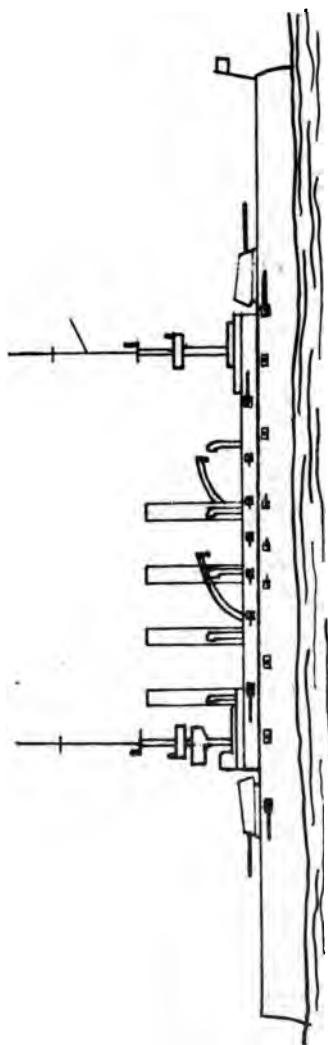


FIGURE 25.—U. S. ARMORED CRUISER "NORTH CAROLINA."

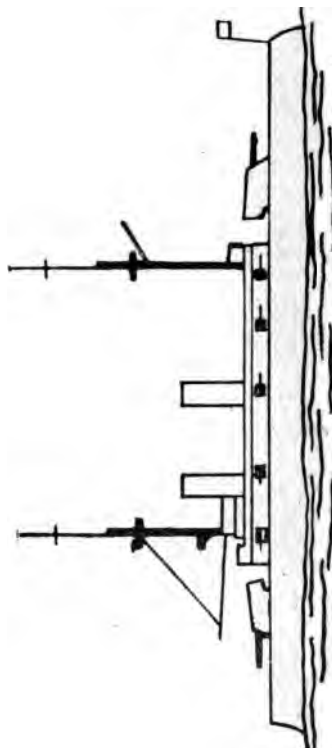


FIGURE 26.—U. S. PROTECTED CRUISER "OLYMPIA."

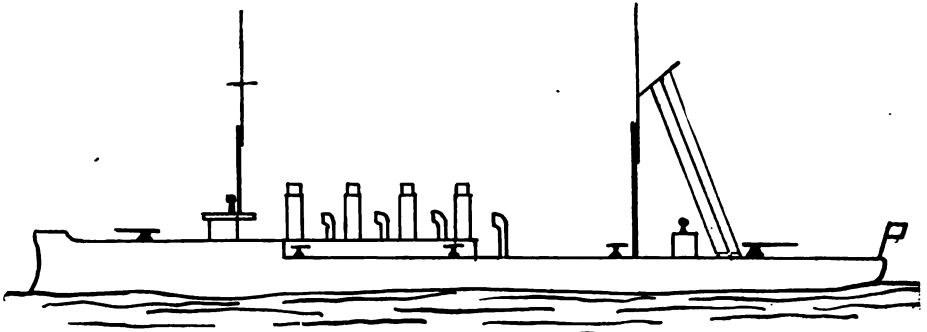


FIGURE 27.—U. S. SCOUT CRUISER "SALEM."

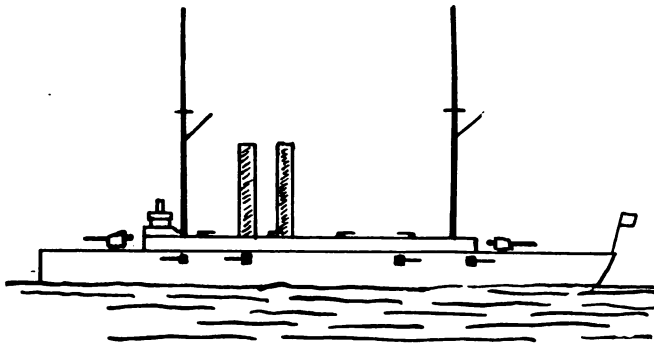


FIGURE 28.—U. S. GUNBOAT "DENVER."

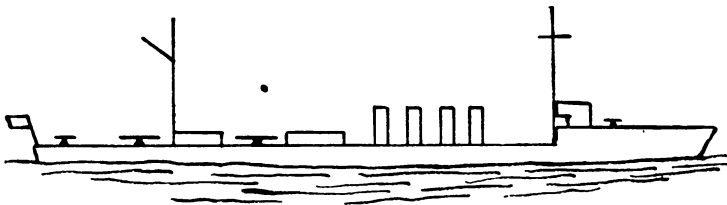


FIGURE 29.—U. S. DESTROYER "TERRY."

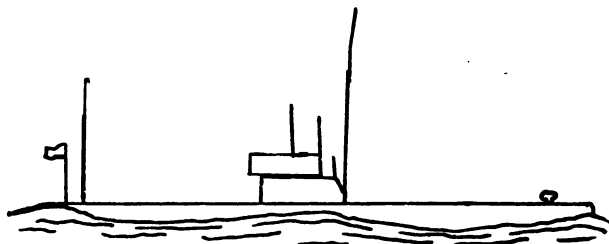


FIGURE 30.—U. S. SUBMARINE "E-1."

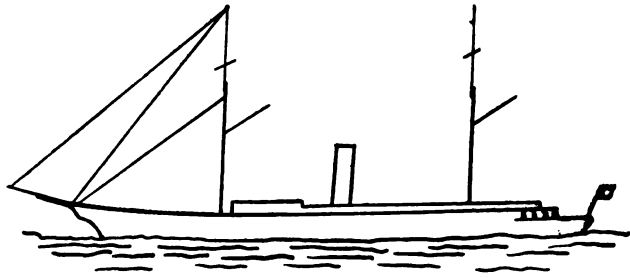


FIGURE 31.—PRESIDENTIAL YACHT "MAYFLOWER."

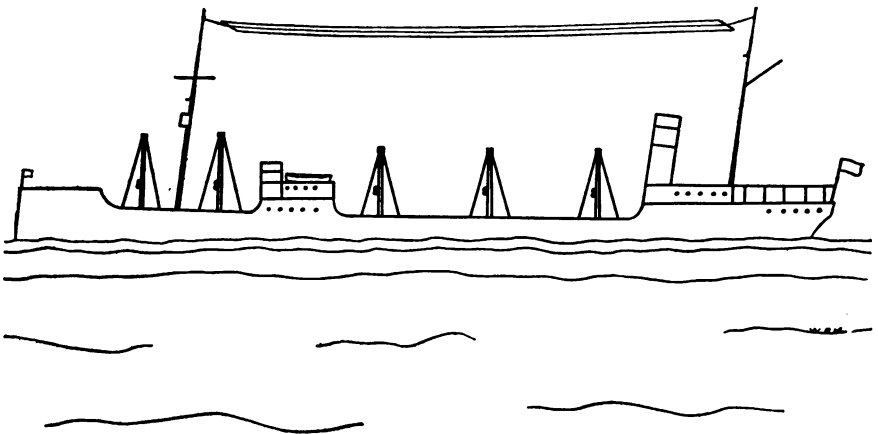


FIGURE 32.—U. S. COLLIER "HECTOR."

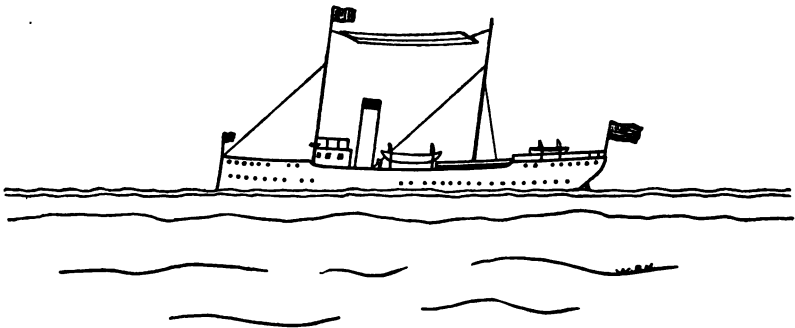


FIGURE 33.—U. S. COAST GUARD CUTTER "ONONDAGA."

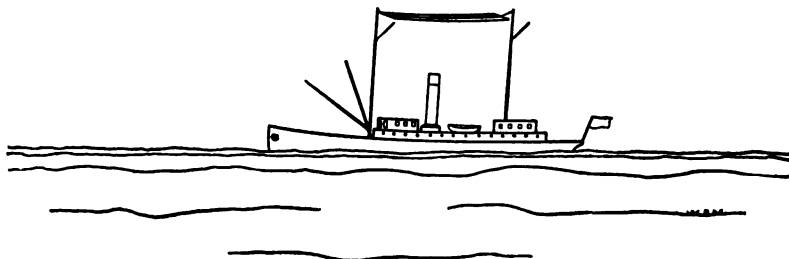


FIGURE 34.—U. S. MINE PLANTER "MILLS."

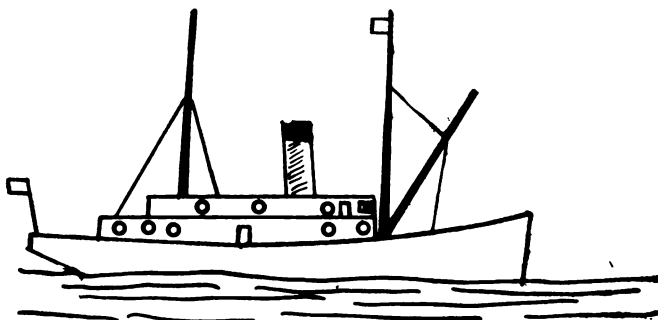


FIGURE 35.—U. S. LIGHTHOUSE TENDER "MAPLE."

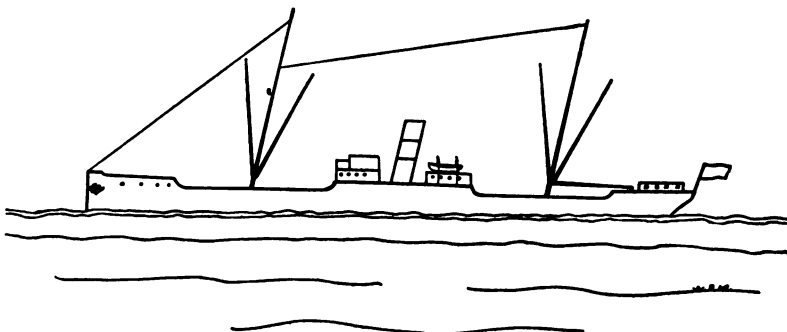


FIGURE 36.—TRAMP STEAMER.

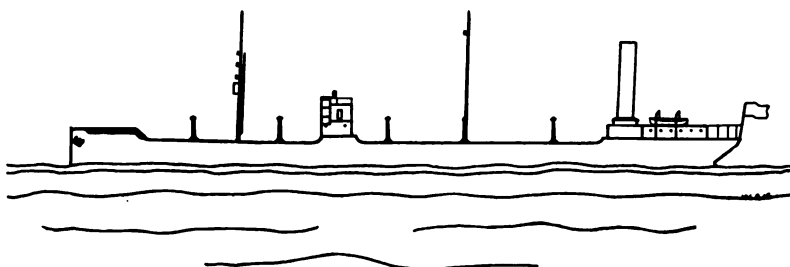


FIGURE 37.—TANK STEAMER.

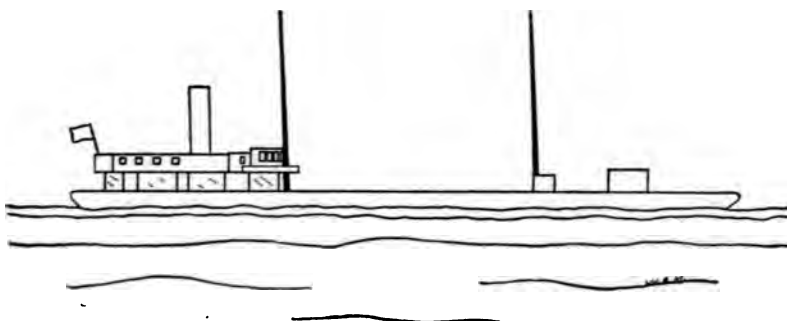


FIGURE 38.—WHALERACK STEAMER.

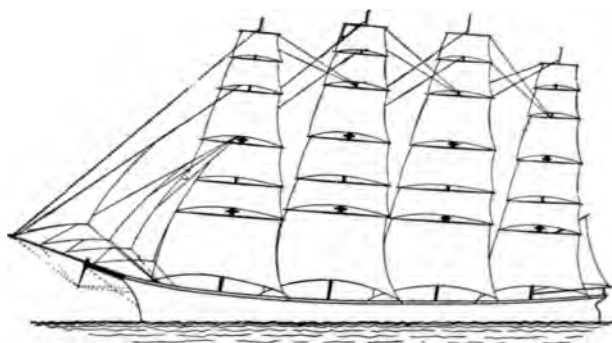


FIGURE 39.—FOUR-MASTED SHIP.

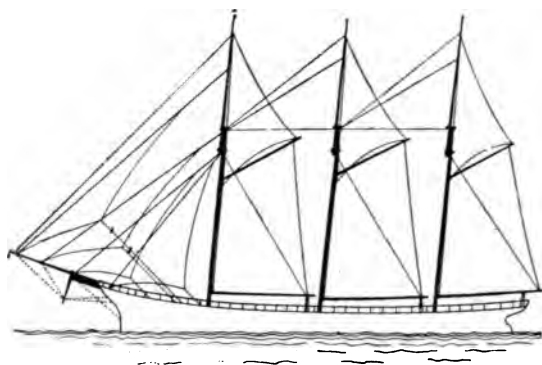


FIGURE 40.—THREE-MASTED SCHOONER.



FIGURE 41.—BARK.

CHAPTER X.

OUTLINE OF FIRE-COMMAND DRILL.

GENERAL INSTRUCTIONS.

1. The following outline of fire-command is given as illustrative drill of the methods by means of which the war-game instruction may be coordinated with the instruction given at the batteries.

Obvious changes will adopt the outline given to that necessary for fort or coast-defense drill.

2. A record of all commands given, and messages sent or received, with time of sending and receiving each, will be kept at all F' and all B. C. stations.

At the conclusion of the drill this record will be examined by the fire commander with a view to correcting errors, to reducing time of transmission, and to causing greater care to be exercised by officers in limiting their messages to those words best adapted to the means of communication.

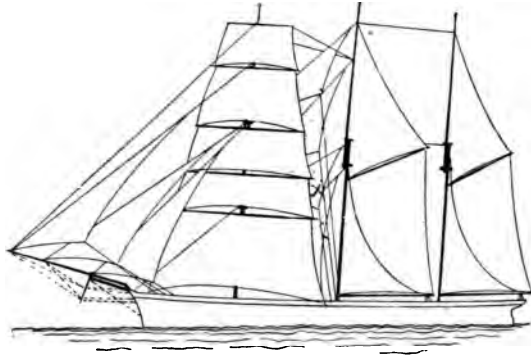


FIGURE 42.—BARKENTINE.

3. The guns will not be tripped during the drill unless special instructions are given.
4. Drill primers will be used.
5. Timepieces will be synchronized at the beginning of the drill.
6. Each battery will be provided with a hit bag. Classes of warships will be represented by various types of commercial craft, which may be common to the locality, as follows:

Four-masted schooner.....	Battle cruiser.
Three-masted schooner.....	Dreadnaught.
Two-masted schooner.....	Battleship.
Tramp steamer.....	Armored cruiser.
Commercial liner.....	Destroyer.
Etc.	

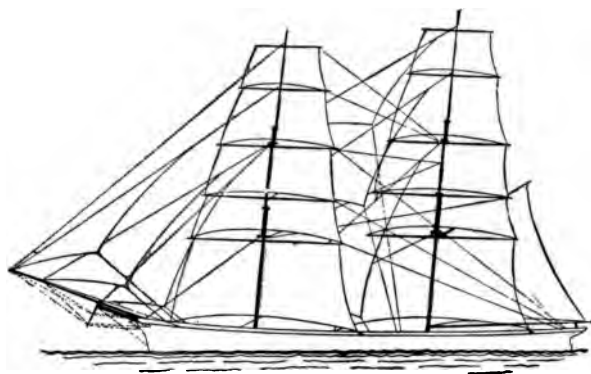


FIGURE 43.—BRIG.

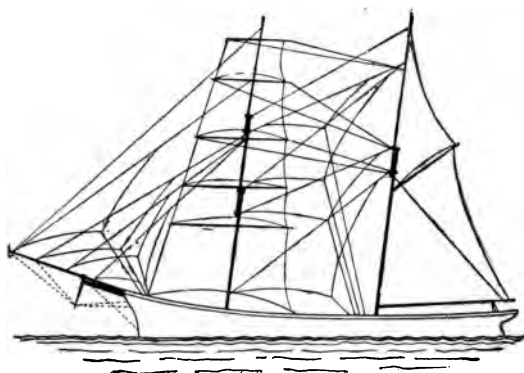


FIGURE 44.—BRIGANTINE.

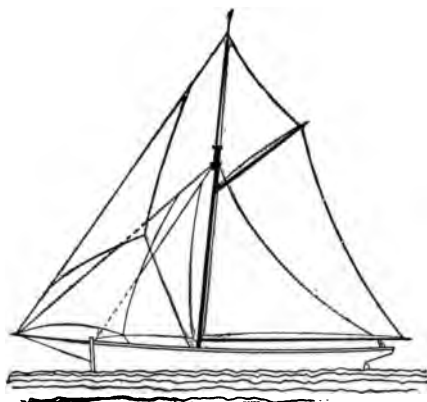


FIGURE 45.—CUTTER.

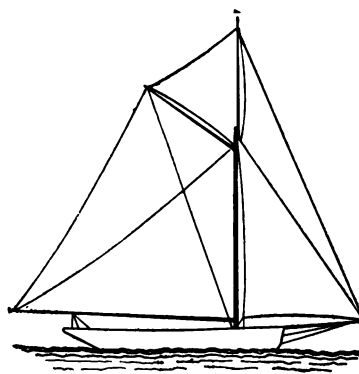


FIGURE 46.—SLOOP.

Lists showing the classes of warships to be simulated by various commercial craft will be posted in each fire, battery, and mine-command station, in each observing station, and at each emplacement and pit.

7. Usually no stated number of rounds will be ordered, but by use of the hit bags sufficient damage, in the judgment of the battery commander, will be put on the target to disable the class of warship it is assumed to represent.

8. Casualty lists will be prepared as indicated below and posted in each fire, battery, and mine-command station, in each observing station, and at each emplacement and pit.

The casualties will be numbered, and when it is desired to consider a particular casualty as having occurred, orders for same will be given as follows:

Casualty 1, or Casualty 2, etc.

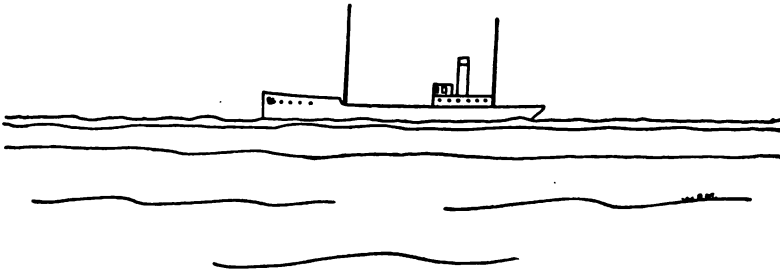


FIGURE 47.—BEAM TRAWLER.

9. The following is given as a list of casualties that should be assumed:

- Casualty 1. Primary station out.
- Casualty 2. Secondary station out.
- Casualty 3. Battery commander's station out, except fire-commander's phone.
- Casualty 4. Primary and secondary out.
- Casualty 5. Primary and battery commander's station out.
- Casualty 6. Battery commander's station and secondary out.
- Casualty 7. Gun No. 1, gun pointer out.
- Casualty 8. Gun No. 2, gun pointer out.
- Casualty 9. Gun No. 1, Nos. 1 and 2 breech detail out.
- Casualty 10. Gun No. 2, Nos. 1 and 2 breech detail out.
- Casualty 11. Battery commander out.
- Casualty 12. Gun No. 1, range keeper's phone out.
- Casualty 13. Gun No. 2, range keeper's phone out.
- Casualty 14. Telescopic sights out.

Declaring a casualty off means that the particular casualty is no longer in force; as, Casualty 1, off.

Casualties once given will remain in force until declared off.

THE DRILL.

The fire commander enters his station after the detail. The noncommissioned officer in charge will command, "Section attention," and salute. Men remain at their proper stations and cease talking.

Timepieces will be synchronized. "All batteries, prepare to take 8.05—10 sec.—5 sec.—Now—8.05."

The message for the day will be sent. "All batteries, daily message—Barometer, 29.95—Thermometer, 70—Atmosphere, 23.5—Wind—Azimuth, 275—Velocity, 20—Tide, plus 2."

NOTE.—In some coast-defense commands this message is sent direct to batteries from meteorological station.

Battery reports are received, as, "Parrott, In Order." If defects that can not be quickly remedied exist, that fact will be reported.

From his own station the fire commander will receive the report from communication officer (or noncommissioned officer acting as such), "Sir, F' In Order."

Fire commander will assign his station to target, as, "Section, attention—Target—Horseshoe—Mine planter, coming in—Class 1-2, track."

The fire commander will cause two or more fixed targets to be located on plotting board of each battery. He will command, "All batteries—Target—Fixed target—Datum point No. 2; Report range;" similarly for any other fixed target.

He then commands, "All batteries—Target—Lynnhaven—Tramp steamer—Class 1-2—Coming in." When all observers of a battery have identified the target the battery commanders will report, "Parrott, On target (description) Tramp—Class 1-2," etc.

"All batteries, change target—Target—Buckroe—Two-masted schooner—Coming in." Reports are received from batteries as above.

NOTE.—The object of these preliminary assignments is to assure the fire commander that the communications are in order, to steady the personnel, and to have common reference points on all track sheets.

The fire commander then selects a target and commands, "All batteries—Target—Lynnhaven—Three-masted schooner—Coming in." It is seen that the schooner will give satisfactory track for drill purposes. The fire commander calls for ranges, as, "All batteries—Three ranges—At eight-twenty." This command calls for three successive actual ranges from primary arm of plotting board, first range given to be the actual range at eight-twenty.

The fire commander will then order, "Change target—All batteries—Target—Lynnhaven—Three-masted schooner—Going out—Casualty 2—COMMENCE FIRING."

Battery commanders will report the results of firing as follows: "Parrott—Target disabled, 10 rounds;" "Church—Target disabled, 15 rounds."

The report of firing having been received, the fire commander will order, "Casualty 4"—and later, "Three ranges at eight-thirty." Again, "All batteries, Casualties 2 and 4—Off; Casualty 3—COMMENCE FIRING." Reports being received, "All batteries—All casualties off—Rest."

Rest should be given from three to five minutes.

In the meantime, the fire commander will select another target which promises a good track; he will call batteries to attention by the command, "All batteries—Attention."

"All batteries—Target—Ocean View—Old Dominion steamer—Class 1-1—Coming out."

"All batteries—Casualties 7 and 8—Commence firing . . . Rest." Reports are received from battery commanders as indicated above.

To put batteries on different targets, fire commander will command, "Parrott and De Russey—Target—Horseshoe—Coal barge division—Coming in—Barge No. 1—COMMENCE FIRING."

"Eustis and Church—Target—Horseshoe—Coal barge division—Coming in—Barge No. 2—COMMENCE FIRING."

"Parrott and De Russey—Change target—Target—Same division—Barge No. 3"—"Eustis and Church—Change target—Target—Same division—Barge No. 4."

"All batteries—Three ranges at eight forty-five."

Similarly other targets will be assigned to the different batteries and other commands given.

Relocation by range and azimuth by the fire commander's range section will be practiced. "Section attention—Target—Horseshoe—Three-masted schooner—Coming in—Track—Relocate for Parrott."

"Parrott, prepare to identify target—Target—Azimuth 155—Range 6.500." "Now" is called by F' observer and repeated over phone to Parrott as target crosses vertical wire. Parrott reports, as, "Parrott, On target." Fire commander orders, "Parrott—Describe." Parrott describes target, and, if correct, fire commander responds, "Target, O. K." If not correct, he answers, "Wrong target," and gives orders for second relocation of target.

Fire commander directs all plotting to be turned in to his office by 12.30 o'clock and orders, "Close station."

CHAPTER XI.

REQUISITIONS AND RETURNS FOR COAST ARTILLERY WAR GAME PROPERTY.

Requisitions for material for construction or supplies for maintenance of the Coast Artillery War Game are prepared by the Artillery Engineer on Requisition for Engineer Property (Form No. 39, Office Chief of Engineers), and after approval by the commanding officer are forwarded to the commanding officer of the Coast Artillery district concerned. After being acted upon by the latter officer the requisition is forwarded to the Coast Artillery War Instruction, Fort Andrews, Mass. When skilled labor is necessary and competent extra-duty labor is not available, the requisition should so state. The approximate cost of all material in local market should be stated.

The property will be invoiced by the disbursing officer of the Coast Artillery War Instruction appropriation to the Artillery Engineer, and will be carried, accounted for, and expended in accordance with the existing rules and regulations for property supplied by the Engineer Department. (See letter No. 2220/12-29, O. C. S., C. A. D., Dec. 4, 1914.)

There is a small annual appropriation for the upkeep of the installations, including painting, renewals of lamps for searchlights, carbons for balopticons, blank forms, etc.

APPENDIX I.

LIST OF COAST GUARD CUTTERS, HARBOR SERVICE AND ARTILLERY BOATS, AND LIGHTHOUSE TENDERS.

[From data furnished by the Coast Artillery division, Office of the Chief of Staff, Apr. 26, 1916, and List of Merchant Vessels of the United States, 1915.]

Coast defenses.	Name.	Class.	Length.	L. H. dist.	Name.	Class.	Tons.	Length.	Depth.	Off.	Men.	Guns.	Station.
Portland.....	Wilson.....	Quartermaster.	110	1	Hibiscus.....	Tender..	677	174	16	6	23	.....	Portland, Me.
	Randol.....	Artillery	98		Zizania.....	do.	417	150	12	8	19	.....	Do.
	Drew.....	Launch.	60		Androsoggin.....	Cutter..	1,065	210	26½	8	66	4	Do.
	Watson.....	do.	40		Ossipee.....	do.	910	165	20½	5	59	4	Do.
Portsmouth.....	No. 24.....	D. B. B.	32	2									
	Morrison.....	Artillery	86										
	No. 27.....	D. B. B.	32										
	Jesup.....	Quartermaster.	130										
Boston.....	Batchelder.....	do.	110	3	Anemone.....	Tender..	677	174	16	7	23	.....	Boston, Mass.
	Anderson.....	Artillery	98		Azalea.....	do.	500	145	12	5	19	.....	Do.
	Schenck.....	Tug.	65		Mayflower.....	do.	572	155	12	5	22	.....	Do.
	Bumpus.....	Launch.	60		Acushnet.....	Cutter..	800	152	16½	3	35	2	New Bedford, Mass.
New Bedford.....	Mitchell.....	do.	45	4	Gresham.....	do.	1,090	205½	17	8	63	4	Boston, Mass.
	No. 25.....	D. B. B.	32		Winnimmet.....	do.	182	96½	10½	1	9	.....	Do.
	Hartshorne.....	Launch.	60										
	No. 31.....	D. B. B.	32										
Narragansett Bay.....	Arnold.....	Artillery	98	5	Daisy.....	Tender..	35	74	5	2	4	.....	Tompkinsville, N. Y.
	Drum.....	Tug.	83		Lilac.....	do.	434	145	15	5	19	.....	Do.
	Smith.....	do.	65		Gardenia.....	do.	150	117	9	4	11	.....	Do.
	Downs.....	Launch.	60		John Rodgers.....	do.	260	151	9	4	16	.....	Do.
Long Island Sound.....	No. 30.....	D. B. B.	32	6	Larkspur.....	Tender..	685	162	14	6	22	.....	Do.
	Pickering.....	do.	110		Mistletoe.....	do.	332	153	9	4	16	.....	Do.
	Ayres.....	Artillery	98		Pansy.....	Tender..	314	147	11	4	17	.....	Do.
	Rovell.....	do.	32		Tulip.....	do.	677	174	16	7	24	.....	Do.
Eastern New York.....	No. 26.....	D. B. B.	32	7	Cahoon.....	Cutter..	170	94½	10½	1	11	.....	New York, N. Y.
	Stanley.....	Quartermaster.	130		Hudson.....	do.	179	96½	10½	1	11	.....	Do.
	Doan.....	Steamer.	85		Mohawk.....	do.	1,145	205½	17	8	63	4	Do.
	Wilcox.....	Tug.	45		Manhattan.....	do.	1,445	204	25½	8	66	4	Tompkinsville, N. Y.
Southern New York.....	Recruit.....	Launch.	33	8	Seneca.....	do.	41	70	8	1	6	.....	Do.
	Harriet.....	do.	32		Grude.....	do.	348	130	11	4	17	.....	Do.
	No. 28.....	D. B. B.	32										
	Williams.....	Lighter.	145										
Sandy Hook.....	Meigs.....	Quartermaster.	132	9									
	Canby.....	Lighter.	97										
	Connell.....	Launch.	60										
	Brown.....	Artillery	98										
	No. 15.....	D. B. B.	32										

1 Side wheel.

San Diego	Harris..... De Russey..... No. 10..... El Aguador..... McDowell..... Cartwright..... Barrett..... Murray..... Alcazar..... No. L. 34.....	Artillery..... Launch..... D. B. B..... Quartermaster..... do..... do..... Artillery..... Tug..... Q. M. launch..... D. B. B.....	105 60 32 146 125 104 58 65 50 64	18	Madrono..... Sequoia..... Golden Gate..... McCulloch..... Hartley..... Bear.....	do..... do..... Cutter..... do..... do..... do.....	411 677 240 1,415 61 1,700	164 174 110 219 6 1/2 198 1/2	15 16 111 18 5 19 1/2	6 6 1 8 1 8	19 23 10 63 6 59	San Francisco, Cal. Do. Do. Do. Do. Do. San Diego, Cal.
Columbia	Formance..... Howard..... No. 9..... Mifflin..... Thomas..... Spruner..... Gurney..... No. L. 35.....	Artillery..... Quartermaster..... D. B. B..... Quartermaster..... Artillery..... Tug..... do..... D. B. B.....	98 85 32 130 105 65 65 64	17	Heather..... Manzanita..... Scout..... Aresata..... Shohomish..... Manning..... Guard.....	Tender..... do..... Cutter..... do..... do..... do..... do.....	731 677 40 138 879 1,153 205	165 174 61 1/2 83 152 67 1/2 188 1/2	15 16 5 1/2 10 1/2 17 1/2 17 9	6 6 1 2 5 8 1	19 23 5 10 26 65 6	Portland, Oreg. Do. Port Townsend. Do. Do. Neah Bay, Wash. Astoria, Oreg. Friday Harbor, Wash.
Honolulu	No. 5..... No. 6.....	do..... do.....	32 32	19	Columbine..... {Thetis.....	Tender..... Cutter.....	24 1,250	115 188 1/2	15 17	6 8	19 58	Honolulu, Hawaii. Do.
Manila Bay	Mitchell..... McConville..... Levi yard..... Tilly..... Florida..... No. 2..... No. 17..... No. 18..... No. 19..... No. 20.....	Launch..... do..... do..... do..... D. B. B..... do..... do..... do..... do..... do.....	90 90 90 65 71 65 32 32 32 32									
Sul'ig Bay	No. 21..... No. 22.....	do..... do.....	32 32									
Panama	C. W. Field..... Foe..... A. G. Forse..... L. 36..... W. W. Wilhelm..... Ramsey..... Capron.....	Cable steamer..... Steam lighter..... Artillery..... D. B. B..... Launch..... do..... do.....	133 92 86 61 60 30 30									

1 Side wheel.

MINE PLANTERS.—Atlantic coast: Mills, Schofield, Ord, Frank. Pacific coast: Arnistead, Ringgold. Philippines: Hunt, Knox, and auxiliary mine planter San Pedro.

APPENDIX II.

WARSHIPS LOST AND DAMAGED DURING THE BOMBARDMENT OF THE DARDANELLES, FROM AUG. 1, 1914, TO JUNE 1, 1915.

Name.	Type.	Tonnage.	Year of building.	Speed.	Guns.	Remarks.
Queen Elizabeth.....	Dreadnaught.....	27,500	1914	28.0	8 15-inch, 16 6-inch.....	Seriously damaged Mar. 15, 1915.
Warspite.....	do.....	27,500	1914	28.0	8 15-inch, 16 6-inch.....	Reported by the New York Herald at strait.
Indomitable.....	Dreadnaught cruiser.....	17,250	1908	28.7	8 12-inch, 16 4-inch.....	Disabled by gunfire Mar. 18, 1915.
Inflexible.....	do.....	17,250	1908	28.4	8 12-inch, 16 4-inch.....	Reported sunk; Admiral Carden and 40 men believed killed.
Africa.....	Battleship.....	16,550	1906	18.2	4 12-inch, 4 9.2-inch, 10 6-inch.....	Reported sunk by gunfire, Mar. 18, 1915.
Agamemnon.....	do.....	16,500	1907	18.5	4 12-inch, 10 9.2-inch.....	Hit three times.
Lord Nelson.....	do.....	16,500	1908	19.0	4 12-inch, 10 9.2-inch.....	Reported sunk by gunfire.
Irresistible.....	do.....	15,000	1902	18.5	4 12-inch, 12 6-inch.....	Sunk Mar. 18, 1915, by mine or gunfire.
Queen.....	do.....	15,000	1904	18	4 12-inch, 12 6-inch.....	
Implacable.....	do.....	15,000	1902	18.7	4 12-inch, 12 6-inch.....	
Illustrious.....	do.....	14,900	1898	16.1	4 12-inch, 12 6-inch.....	
Prince George.....	do.....	14,900	1896	16.3	4 12-inch, 12 6-inch.....	
Majestic.....	do.....	14,900	1895	16.8	4 12-inch, 12 6-inch.....	
Cornwallis.....	do.....	14,000	1904	19.56	4 12-inch, 12 6-inch.....	Sunk by German submarine May 28, 1915.
Ocean.....	do.....	12,950	1900	17.8	4 12-inch, 12 6-inch.....	Damaged.
Vengeance.....	do.....	12,950	1901	18.0	4 12-inch, 12 6-inch.....	Sunk Mar. 18, 1915, by mine or gunfire.
Albion.....	do.....	12,950	1902	18.2	4 12-inch, 12 6-inch.....	Set on fire Apr. 28, 1915.
Canopus.....	do.....	12,950	1900	16.5	4 12-inch, 12 6-inch.....	
Euryalus.....	Armored cruiser.....	12,000	1903	20.3	2 9.2-inch, 12 6-inch.....	Engine room destroyed and its personnel was killed.
Triumph.....	Battleship.....	11,800	1904	19.3	4 10-inch, 14 7.5-inch.....	Sunk by German submarine off Gallipoli May 27, 1915.
Swiftsure.....	do.....	11,800	1904	19.1	4 10-inch, 14 7.5-inch.....	
Minerva.....	Second class protected cruiser.....	5,000	1897	19.5	11 6-inch.....	Damaged.
Dublin.....	do.....	5,000	1912	26.0	8 6-inch.....	Badly damaged; 28 men killed.
Amethyst.....	do.....	3,000	1903	20.0	12 4-inch.....	Seriously damaged.
Sapphirer.....	Third-class protected cruiser.....	3,000	1905	22.3	12 4-inch.....	Sunk May 14, 1915, by Turkish destroyers; 570 men lost.
Goliath.....	Battleship.....	12,950	1900	17.3	4 12-inch, 12 6-inch.....	
London.....	do.....	15,000	1902	17.75	4 12-inch, 12 6-inch.....	
Defence.....	do.....	14,000	1908	21	4 9.2-inch, 10 7.5-inch.....	
Doris.....	Cruiser.....	5,600	1896	19.5	11 6-inch.....	
Waldeck Rousseau.....	Light cruiser.....	5,600	1896	23.1	14 7 6-inch.....	
Suffren.....	Armored cruiser.....	14,000	1910	23.1	4 12-inch, 10 6.4-inch, 8 4-inch.....	Seriously damaged and disabled.
Bouvet.....	Battleship.....	12,750	1903	14.0	2 12-inch, 2 10.8-inch, 8 5.5-inch, 8 4-inch.....	Sunk by mine or torpedo Mar. 18, 1915; 630 men killed.
Bouvet.....	do.....	12,205	1898	17.1	2 12-inch, 2 10.8-inch, 8 5.5-inch, 8 4-inch.....	
Jaureguiberry.....	do.....	11,900	1896	17.8	2 12-inch, 2 10.8-inch, 8 5.5-inch, 8 4-inch.....	
Charlemagne.....	do.....	11,250	1899	18.1	4 12-inch, 10 5.5-inch, 8 4-inch.....	

Gaulois.....	do.....	11, 200	1899	18.2	4 12-inch, 10 5.5-inch, 8 4-inch.	Disabled by mine or gunfire
Henry IV.....	do.....	8, 948	1903	17.5	2 10.8-inch, 7 5.5-inch.....	
D'Entrecasteaux.....	First class protected cruiser.....	8, 114	1898	18.0	2 9.4-inch, 12 5.5-inch.....	
Jeanne d'Arc.....	Armored cruiser.....	11, 270	1903	21.7	2 7.6-inch, 14 5.5-inch.....	Set on fire Apr. 28, 1915.
Askold.....	Protected cruiser.....	6, 300	1901	22.9	12 6-inch.....	

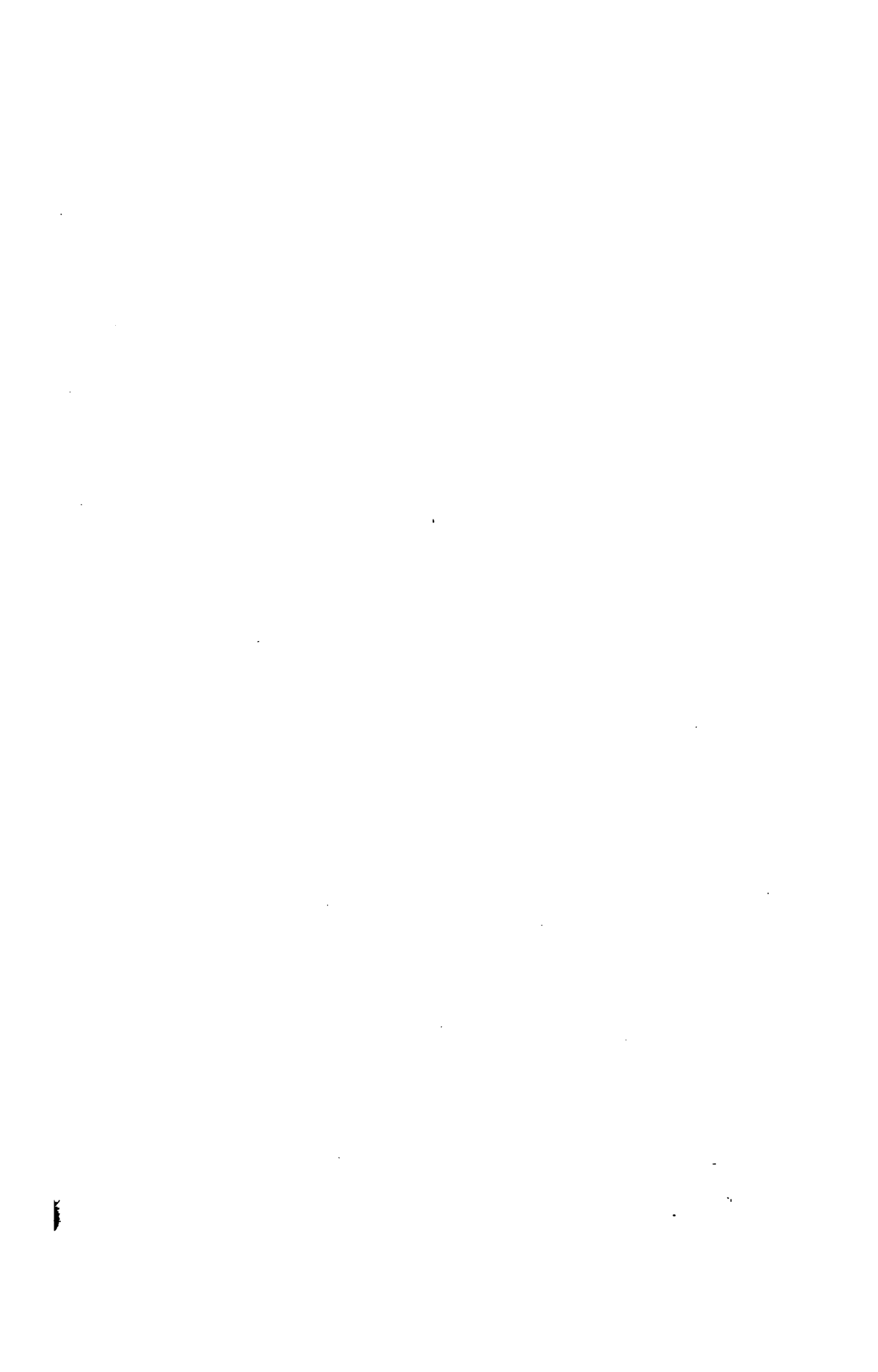
APPENDIX III.

TABLE SHOWING EFFECTS OF FIRE AGAINST MODERN VESSELS.

Ships.	Class.	Tons.	Flag.	Launched.	Date of battle.	Hits.			Remarks.
						Major caliber.	Rapid-fire.	Below water line.	
Varlag.....	F.....	6,500	Russian.	1899	Feb., 1901	23		2	Returned to Chemulpo. Sunk by crew. Now Japanese Soya.
Atsuta.....	F.....	6,500	do.	1900	Aug., 1904	15	3	2	Escaped to Shanghai and interned.
Diana.....	F.....	6,630	do.	1899	do.			1	Escaped to Saigon and interned.
Tsarévitch.....	A.....	13,500	do.	1901	do.	17		1	Escaped to Kien Chai and interned.
Pobeda.....	A.....	12,500	do.	1900	Dec., 1904	4		1	Returned to Port Arthur. Now Japanese Suwo.
	A.....	12,500	do.	1900	do.				Sunk by crew in Port Arthur. Mortar fire (25 cm. mortars), 203 Meter Hill.
Mikasa.....	A.....	15,200	Japanese	1900	Aug., 1904	1		1	Serious hole. No damage owing to smooth sea.
Rurik.....	C.....	11,000	Russian.	1892	do.			1	All guns disabled. Beached and abandoned.
Rosita.....	C.....	12,500	do.	1896	do.	11			11 holes below water, 17 out of 20 guns disabled. Returned to Vladivostok.
Gromobol.....	B.....	12,500	do.	1899	do.	6			6 holes below water, 17 out of 20 guns disabled. Returned to Vladivostok.
Retvisan.....	A.....	12,500	do.	1900	Dec., 1904				Upper works badly shattered. Mortar fire, 203 Meter Hill.
Perevlet.....	A.....	12,500	do.	1898	do.	12			Sunk by crew in Port Arthur.
Bayan.....	B.....	7,800	do.	1900	do.	3			4 shots penetrated protected deck. Mortar fire, 203 Meter Hill. Sunk by crew. Now Japanese Sagami.
Polava.....	N.....	11,000	do.	1894	do.	3			All penetrated protected deck. Sunk by crew. Now Japanese Asa.
Pallada.....	F.....	6,000	do.	1900	do.	7			Effect of hits not known. Sunk by crew. Now Japanese Tango.
Orel.....	A.....	13,500	do.	1901	May, 1905	42			Effect of hits not known. Sunk by crew. Now Japanese Tsugaru.
Oleg.....	F.....	6,250	do.	1903	do.	7			Sundered May 28, 1905. Now Japanese Iwami.
Zemitchug.....	F.....	3,200	do.	1903	do.				Escaped to Manila.
Asama.....	B.....	9,750	Japanese	1898	do.			3	Escaped to Manila. Badly damaged above water-line.
Naniwa.....	F.....	3,700	do.	1885	do.			1	Left line temporarily.
Kasagi.....	C.....	4,750	do.	1888	do.			1	Do.
Aurora.....	F.....	6,630	Russian.	1899	do.	2			Do.
Osabya.....	A.....	12,500	do.	1898	do.	35		2	Escaped to Manila. Hits estimated.
Souvarof.....	A.....	13,500	do.	1903	do.	1007			Sunk by gunfire. Hits estimated.
Alexander III.....	A.....	13,500	do.	1901	do.	357			Do.
Borodino.....	A.....	13,500	do.	1901	do.	357			Do.
Sisoid Veliky.....	N.....	9,000	do.	1904	do.	12			Sunk by torpedo, May 28.
Ural (scout).....	V.....		do.	1902	do.			1	Sunk. This was an unarmed vessel.
Gromy.....	V.....	356	do.	1904	do.		6	1	Did not sink. Escaped to Vladivostok.

Ching Yuen.....	N.....	2,300	Chinese.....	1886	Feb., 1895	1						Sunk by one 10-inch shell from land forts. Had been damaged at Yalu.
Ting Yuen.....	F.....	7,430	do.....	1881	Sept., 1894	4	2007					Withdraw.
Chen Yuen.....	N.....	7,430	Chinese.....	1882	Sept., 1894	4	2007					Withdraw.
King Yuen.....	B.....	2,850	do.....	1887	do.....							Sunk by gunfire.
Chi Yuen.....	F.....	2,300	do.....	1886	do.....							Do.
Yung Wei.....	F.....	1,350	do.....	1881	do.....	15						Ran aground. Badly damaged.
Chao Yung.....	F.....	1,350	do.....	1881	do.....							Withdrawn damaged and in flames. Was rammed and sunk by Tsi Yuen (Chinese).
Kuang Chia.....	F.....	1,296	do.....	1875	do.....	4						Withdrawn damaged and ran aground.
Sakito Maru.....	F.....	2,780	Japanese.....	1875	do.....	11	10					Withdraw. Converted merchant ship.
Matsumima.....	F.....	4,277	do.....	1880	do.....	4	(?)					Withdraw.
Itsukushima.....	F.....	4,277	do.....	1889	do.....	3	(?)					Do.
Ships.	Class.	Tons.	Flag.	Launched.	Date of battle.	Hits.					Remarks.	
						12-inch.	8-inch.	6-inch.	5-inch.	4-inch.		6-pdr.
Reina Cristina.....	F.....	3,520	Spanish.....	1886	May, 1898		5		18		16	Probably more hits; estimated 70. Put out of action and then sunk by crew.
Castilla.....	F.....	3,342	do.....	1881	do.....		3	2	16		19	Probably more hits. Put out of action and then sunk by crew.
Don Antonio de Ulloa.....	F.....	1,130	do.....	1887	do.....		4	3	15		11	Probably more hits. Sunk by holes along water line.
Don Juan de Austria.....	F.....	1,130	do.....	1889	do.....		2		4		7	Complete record. Sunk by crew.
Isla de Cuba.....	F.....	1,030	do.....	1887	do.....				3		5	Do.
Isla de Luzon.....	F.....	1,030	do.....	1887	do.....							Do.
Velasco.....	F.....	1,132	do.....	1881	do.....		1	1			1	Probably all. Sunk by crew.
Marques del Duero.....	DV.....	500	do.....	1875	do.....						3	Probably more hits. Sunk by crew.
General Lezo.....	GB.....	500	do.....	1885	do.....							Ran aground on fire.
Vizcaya.....	B.....	7,000	do.....	1891	July, 1898		5		7	4	13	Do.
Oquendo.....	B.....	7,000	do.....	1891	do.....				3	6	43	Do.
Maria Teresa.....	B.....	7,000	do.....	1890	do.....	2	3	1	3	1	17	Do.
Colon.....	B.....	6,840	do.....	1896	do.....		1	1	2		4	Ran aground and surrendered.
Iowa.....	A.....	11,340	United States.....	1896	do.....				2	2		Uninjured.
Oregon.....	A.....	10,288	do.....	1893	do.....				2	2		Do.
Indiana.....	A.....	10,288	do.....	1893	do.....				2	2		Do.
Brooklyn.....	B.....	9,215	do.....	1895	do.....			2	3		10	Went immediately in pursuit of another supposed enemy.
Texas.....	B.....	6,315	do.....	1892	do.....						1	Uninjured.

15 or 4.7-inch.



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